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1720 Analog Sweep

INSTRUMENT DIVISION

ADDENDUM

This addendum covers changes to the 1720 when the Analog Sweep option is added. The adendum is in three sections - front panel operation IEEE operation and specifications.

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FRONT PANEL OPERATION
for the
1720 MICROWAVE SYNTHESIZER
with the
ANALOG SWEEP OPTION

The front panel operates the same as the standard 1720 except for the following keys, some of which must be called as second or shifted functions:

STORE

To store the front panel setup, press SHIFT (the LED flashes), then STORE (the SHIFT LED turns on), then the digit for the desired register. The settings are stored and the SHIFT LED turns off.

RECALL

To recall a front panel setup, press SHIFT (the LED flashes), then RECALL (the SHIFT LED turns on), then the digit for the desired register. The setup is displayed and the SHIFT LED turns off.

STEP

The step size or increment is only relevant to digital level sweep. Press SHIFT (the LED flashes), then step (the SHIFT and STEP LED's turn on), followed by the numeric data and unit of measure.

RATE

The rate or dwell time is only relevant to digital level sweep. Press Shift (the LED flashes), the RATE (the SHIFT and RATE LED's turn on), followed by the numeric data and unit of measure.

MARKER SELECT and MARKER ON/OFF

Specify the marker to be viewed and/or edited by pressing MARKING SELECT (the LED flashes), and then a digit from 0 to 9 (the MARKER SELECT LED turns off). The character "F", the marker number, and a dash are displayed in the modulation window, the marker frequency is displayed in the frequency window, and the marker's status (enabled or disabled) is shown by the LED on the MARKER ON/OFF key. The cursor flashes and the marker frequency may be modified by entering new data via the data entry keypad or by using the edit keys. The marker's status may be changed by toggling the MARKER ON/OFF key. The 1720 will allow a marker to be enabled even though its frequency lies outside the range between the start and sop frequencies.

SWEEP TIME

The sweep time (from start frequency to stop frequency) is only relevant to analog frequency sweep. Press SWEEP TIME (LED turns on and current time is displayed in the frequency window) and enter or modify data with the data entry or edit keys.

PROGRAMMING

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1. NATIVE LANGUAGE

This section describes the GPIB Device Commands used for remote control of 1720 series Microwave Synthesizers with Option 10, the Analog Sweep capability.

The Device Commands have a one-to-one correspondence to the front panel controls, except the "EDIT" group of controls are not available in remote control.

2. DEVICE COMMANDS

The following is the table of Device Commands with their descriptions, and also the equivalent key presses.

2.1 FREQUENCY PROGRAMMING

DEV. CMD.	KEYS	DESCRIPTION
FREQ <num. val.>	FREQ <digit>... <units>	Set the Frequency. The Device Command numeric value is in Hertz.

2.2 LEVEL PROGRAMMING

DEV. CMD.	KEYS	DESCRIPTION
LEVEL <num. val.>	LEVEL <digit>... (+dBm : -dBm)	Set the Level. The Device Command numeric value is in dBm.
RF (ON : OFF)	RF ON	RF Output on or off.
ALC (EXT : INT)	The ALC Switch is on the Rear Panel.	Select External or Internal Level Detector for the Automatic Level Control.
ATTN <num. val.>	SHIFT RECALL <dec. pt.> 30 <units> LEVEL [1] <digit> 0 (+ dBm : - dBm)	Set the Attenuator. The numberic value is in dB. The sign is always ignored. The key presses given cause the Attenuator setting to be displayed and then changed. The EDIT keys can also be used.
VERN <num. val.>	SHIFT RECALL <dec. pt> 3 1 <units> LEVEL <digit>... (+dBm : -dBm)	Set the Vernier DAC. The numeric value is in dBm. The key presses given cause the Vernier DAC setting to be displayed and then changed. The EDIT keys can also be used.

2.3 MODULATION PROGRAMMING

DEV. CMD.	KEYS	DESCRIPTION
PULSE (ON : OFF)	PULSE	Pulse Modulaton on or off.
AM (ON : OFF)	AM	Amplitude Modulation on or off.
FM (ON : OFF)	FM	Frequency Modulation on or off.

2.4 SWEEP CONTROL

DEV. CMD.	KEYS	DESCRIPTION
SWEEP (ON : OFF)	SWEEP ON	Sweep turned on or off.
SWEEP (SNGL : CONT)	SINGLE	Single Sweep or Continuous Sweep.
STEP AUTO	SHIFT RECALL <dec. pt.> 4 3	The Sweep is stepped automatically after the time delay set by the Freq. Rate or Level Rate front panel entry or Device Commands. Also cancels Sp. Fnc. #46.
STEP MAN	SHIFT RECALL <dec. pt.> 4 5 <units>	The Sweep is stepped manually by the Step push button (with SHIFT push button is flashing), or on receiving "STEP<Cr><Lf>". Also cancels Sp. Fnc. #46.
SPC 46	SHIFT RECALL <dec. pt.> 4 6 <units>	Enable the Analog Freq. Sweep (Option 10). Note: Synthesizers with Option 10 have this function automatically enabled when power is turned on.

2.4 SWEEP CONTROL CONT.

DEV. CMD.	KEYS	DESCRIPTION
STEP<Cr><Lf>	SHIFT STEP	The command to step the Sweep when in the Manual Step mode and the sweep is on.
SWEEP FREQ	FREQ	Sweep the Frequency. The FREQ Push Button Indicator LED is on, and the LEVEL PBI LED is off.
SWEEP LEVEL	LEVEL	Sweep the Level. The LEVEL Push Button Indicator LED is on, and the FREQ PBI LED is off.
SWEEP BOTH	FREQ (START : STOP : SHIFT STEP SHIFT RATE) LEVEL -or- LEVEL (START : STOP) FREQ	SWEEP both the Frequency and Level. Both the FREQ AND LEVEL Push Button Indicator LEDs are on. Front panel selection of Sweep both Freq. and Level is implied by displaying or entering the Freq. Start, Stop, Step or Rate parameters, and then displaying or entering Level Start or Stop. Note: This sweep mode is allowed only when Sp. Fnc. #46 (Analog Sweep) is disabled.

2.5 SWEEP PARAMETERS

DEV. CMD.	KEYS	DESCRIPTION
FREQ START <num. val.>	FREQ START <digit>... <units>	Set the Sweep Start Frequency. The Device Command numeric value is in Hertz.
FREQ STOP <num. val.>	FREQ STOP <digit>... <units>	Set the Sweep Stop Frequency. The Device Command numeric value is in Hertz.
MARKER <mkr. no.> FREQ <num. val.>	MARKER SELECT <mkr. no.> <freq. digit>... <units>	Set the Frequency and enable the selected Marker. The marker number is a digit from 0 through 9. The Device Command numeric value is in Hertz.
MARKER<digit> (ON : OFF)	MARKER SELECT <digit> MARKER ON/OFF	Enable or disable the selected marker.
SWEEP TIME <num. val.>	SWEEP TIME <digit>... mS	Set the Sweep Time for Analog Frequency Sweep (Sp. Fnc. #46 enabled). The Device Command numeric value is in Seconds and is the time from Start Freq. to Stop Freq.
FREQ STEP <num. val.>	FREQ SHIFT STEP <digit>... <units>	Set the Frequency Step size for Digital Frequency Sweep or both Freq. and level Sweep (Sp. Fnc. #46 disabled). The Device Command numeric value is in Hertz.
FREQ RATE <num. val.>	FREQ SHIFT RATE <digit>...mS	Set the Freq. Sweep Rate for Digital Frequency Sweep or both Freq. and Level Sweep (Sp. Fnc. #46 disabled). The Device Command numeric value is in Seconds and is the time delay for each step.
LEVEL START <num. val.>	LEVEL START <digit>... (+dBm : -dBm)	Set the Sweep Start Level. The Device Command numeric value is in dBm.

2.5 SWEEP PARAMETERS CON'T

DEV. CMD.	KEYS	DESCRIPTION
LEVEL STOP <num. val.>	LEVEL STOP <digit>... (+dBm : -dBm)	Set the Sweep Stop Level. The Device Command numeric value is in dBm.
LEVEL STEP <num. val.>	LEVEL SHIFT STEP <digit> (+dBm : -dBm)	Set the Level Sweep Step size. The Device Command numeric value is in dB, and its sign is ignored.
LEVEL RATE <num. val.>	LEVEL SHIFT RATE <digit>...mS	Set the Level Sweep Rate by setting the time delay for each step. The Device Command numeric value is in Seconds.

2.6 REFERENCE TIME BASE CONTROL

DEV. CMD.	KEYS	DESCRIPTION
REF AUTO	SHIFT RECALL <dec. pt.> 5 0 <units>	The Reference Time Base is automatically selected. If an External Reference is present at the rear panel connector, then it is used instead of the Internal Reference.
REF INT	SHIFT RECALL <dec. pt.> 5 1 <units>	The Internal Reference Time Base is selected.
REF EXT	SHIFT RECALL <dec. pt.> 5 2 <units>	The External Reference Time Base is selected. If an External Reference is not present at the rear panel connector, the A12 VCXO Unlocked message is generated.

2.7 MISCELLANEOUS PROGRAMMING

DEV. CMD.	KEYS	DESCRIPTION
STOR <digit>	SHIFT STORE <digit>	Stores Synthesizer's setup into one of ten Nonvolatile Storage Registers, which are numbered from 0 to 9. The ten Storage Registers are in the battery backed-up RAM on the A2 board.
RECL <digit>	SHIFT RECALL <digit>	Recalls Synthesizer's setup from one of ten Nonvolatile Storage Registers.
SPC <num. val.>	SHIFT RECALL	Special Function number entry. See the table of Special Functions, section 6.0 of this addendum.

3.0 NUMERIC VALUE SYNTAX

The Device Commands listed with the argument "<num val.>" will accept integer, signed integer or floating point type formats. Any leading spaces are ignored. The folowing are examples of the value one million that would be accepted.

```
 1000000
+1000000
 1E6
+1.000000E+6
 0.001E+09
```

4.0 GPIB ADDRESS

4.1 FRONT PANEL DISPLAY

Pressing the LOCAL/REMOTE push button indicator (PBI) will display "IEE" and the GPIB Device Address of the Synthesizer.

4.2 FRONT PANEL ENTRY

Press the LOCAL/REMOTE PBI, one or two digits, then a terminator (GHz, MHz, or KHz) to change the Address. An entered Address between zero and 30 inclusive is stored in the battery backed-up RAM and in the Address Register of the GPIB Interface Adapter chip.

4.3 NON-NOLATILE MEMORY

The GPIB Device Address is stored in the battery backed-up RAM an the A2 board. When the Synthesizer is powered up, the Address copied from the battery backed-up RAB to the Address Register in the GPIB Interface Adapter chip.

5.0 SPECIAL FUNCTIONS

5.1 LOCAL (FRONT PANEL) OPERATION

Pressing the SHIFT push button, RECALL push button and then the Decimal Point push button will display "SF" and the number of the Special Function stored the Non-volatile Special Function Register, or will display the Synthesizer model number if the Non-volatile Special Function Register is empty.

Press the SHIFT push button, RECALL push button, the Decimal Point, one to four digits, and then a units push button (GHz, MHz, or KHz) to enable a Special Function. Pressing the RECALL button "shifts" the Decimal Point button to a Special Function button. The Special Function number entered must not include any extra leading or trailing zeros in order to be recognized as being valid. See the Table of Special Function Numbers.

5.2 NON-VOLATILE MEMORY

The Non-volatile Special Function Register is in the battery backed-up RAM on the A2 board. When the Synthesizer is powered up, the Special Function number stored in the register is automatically activated.

The Electrically Erasable PROM contains the Level Correction Factor Calibration Table. The Electrically Erasable PROM is write protected by a Shorting Block on the A2 board. With the power off, moving the Shorting Block to the left to short pins 1 and 2 will enable writing the Electrically Erasable PROM. It is recommended to leave the Shorting Block on the right most pair of pins, 2 and 3 to write protect the Electrically Erasable PROM.

5.3 REMOTE (GPIB) OPERATION

5.3.1 DEVICE COMMANDS

The GPIB Device Command used to perform a Special Function is "SPC" followed by a numeric value. See the Table of Special Function Numbers, section 6.

Some Special Functions available only by Remote Control have Device Commands with a different format. See the Table of Special Device Commands, section 7.

6.0 TABLES OF SPECIAL FUNCTION NUMBERS

The following are tables of Special Function numbers with a description of the operation(s) performed given for each function. Each table groups the Special Functions according to the purpose of the function.

6.1 INITIALIZATION

NUMBER	DESCRIPTION
0	Clears or turns off some Spec. Func., clears the Non-volatile Spec. Func. Resister.

6.2 DISPLAY CONTROL

NUMBER	DESCRIPTION
10	Enables display of measured level. No affect on any non-volatile memory. Turned off by Spec. Func. 0.

6.3 LEVEL CONTROL

NUMBER	DESCRIPTION
30	The Attenuator setting is displayed and then can be changed by using the DATA ENTRY or EDIT push buttons. This is equivalent to the "ATTN" Device Command. Part of the Attenuator Hold feature. Canceled by pressing Level P.B. or using LEVEL Cmd.
31	The Verier DAC setting is displayed and then can be changed by using the DATA ENTRY or EDIT push buttons. This is equivalent to the "VERN" Device Command. Part of the Attenuator Hold feature. Canceled by pressing Level P.B. or using LEVEL Cmd.

6.4 SWEEP CONTROL

NUMBER	DESCRIPTION
45	The Sweep is stepped manually by the STEP push button, or by the "STEP<Cr><Lf>" Device Command. This function disables the Analog Freq. Sweep and enables the Digital Freq. Sweep.
46	This function enables the Analog Freq. Sweep and disables the Digital Freq. Sweep. Note: Synthesizers with Option 10 have this function automatically done at power up.

6.5 REFERENCE TIME BASE CONTROL

NUMBER	DESCRIPTION
50	The Reference Time Base is automatically selected. If an External Reference is present at the rear panel connector, then it is used instead of the Internal Reference. This Spec. Func. is equivlent to the "REF AUTO" Device Command.
51	The Internal Reference Time Base is selected. This Spec. Func. is equivalent to the "REF INT" Device Command.
52	The External Reference Time Base is selected. If an External Reference is not present at the rear panel connector, the A12 VCXO Unlocked message is generated. This Spec. Func. is equivalent to the "REF EXT" Device Command.

7.0 TABLE OF SPECIAL DEVICE COMMANDS

The following is the table of Special Device Commands with their descriptions.

DEV. CMD.	DESCRIPTIONS
SRQ 0	Disables generation of a Service Request on the GPIB.
SRQ 1	Enables generation of a Service Request on the GPIB when there is any abnormal operation detected and there is a Fault Message waiting to be output. This feature is off at power up and after doing a Device Clear.
PET	Tells the Synthesizer that the GPIB controller is a Commodore PET, and causes the colons to be removed from the Fault Messages. This feature is off at power up and after doing a Device Clear.

Option 10 (Analog Sweep) Specifications

(15°- 35°c, 250 ms Sweep time.)

FREQUENCY

Start/Stop frequency range	Full range of unit.
Resolution	0.1 Hz.
Sweep Width Accuracy (ΔF)	$\Delta F \leq$ 10 MHz: $\pm$ 100 Khz. $\Delta F >$ 10 MHz: $\pm$ 1 Mhz $\pm$ 2.5% of ΔF.
Residual FM is swept mode & start frequency accuracy	$\Delta F \leq$ 10 Mhz: $\pm$ 50 KHz $\Delta F >$ 10 MHz: $\pm$ 250 KHz (band 4.) 500 kHz (bands 1,2 & 3.)
Markers	10 individually selected. Marker accuracy equal to sweep width accuracy.
Marker Range	2% to 98% of swept range.
Frequency Bands	0.05-0.995 GHz (Band 1.) 0.995-2 GHz (Band 2.) 2-8 GHz (Band 3.) 8-18 GHz (Band 4.)
Filterchange Frequencies	3 GHz, 5 GHz, 12 GHz.
Frequency drift during sweep	< 100 KHz/sec typical.

TIME

Sweep time	150 ms - 20 sec.
Accuracy	± 5%.
Retrace Time	170 ms, typical.
Dwell at band change	< 200 ms, typical.
Dwell at filter change	5 ms, nominal.
Dwell at Markers	5 ms, nominal.

LEVEL

Maximum specified levelled output	Same as standard 1720 - 3dB. Typically > +10 dBm.
Level accuracy	Same as standard 1720.
Swept level flatness	Same as standard 1720 ± 2dB.

OUTPUTS

Ramp	0V (start of sweep)- 10V (end of sweep).
Marker	TTL high, 5ms, nominal. Sweep is held during marker duration.
Blanking	TTL high during retrace, band changes, and filter changes. -4V, 5μs pulse, approx, at start of markers.

NOTE: Marker output is RF valid signal during digital sweep.

SYSTRON DONNER
Member THORN EMI Group

1700 Series

INSTRUMENT DIVISION

MICROWAVE SYNTHESIZER

Document No. 120087-01

OPERATOR'S MANUAL

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SYSTRON DONNER
INSTRUMENT DIVISION
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WARRANTY POLICY

I Warranty

Systron Donner Instrument Division warrants that at the time of shipment the products manufactured by Systron Donner and sold hereunder will be free from defects in material and workmanship and will conform to the current specifications published by Systron Donner's Instrument Division.

II Warranty

A The warranty period will be one year from the date of shipment. This warranty is extended only to the original buyer.

III Warranty Adjustments

A. If any defect within this warranty appears, Purchaser shall notify Seller immediately.

B Systron Donner agrees to repair or furnish a replacement for, but not install, any product which within the standard warranty shall, upon test and examination by Systron Donner, prove defective within the above warranty period.

C No product will be accepted for return or replacement without prior approval of Systron Donner. Upon such authorization and in accordance with instructions of Systron Donner, the product will be returned to the manufacturing location, shipping charges prepaid by Purchaser.

IV Exclusions from Warranty

A The foregoing warranty is in lieu of and excludes all other expressed or implied warranties of merchantability or fitness or otherwise.

B Systron Donner will not be liable for any special or consequential damages or for loss, damages or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with any other equipment or material, or from any other cause.

C The warranty does not extend to any product manufactured by Systron Donner which has been subjected to misuse, neglect, accident, improper installation or to use in violation of instructions furnished by Systron Donner.

D The warranty does not extend to or apply to any unit which has been repaired or altered at any place other than Systron Donner; by persons not expressly approved by Systron Donner; not to any unit, the serial number of which has been removed or defaced or Changed.

E This warranty applies to new equipment only and will cover repaired or replacement items only to the extent of the balance remaining of the items original warranty period noted in Paragraph II.

F All freight charges will be paid for by the Purchaser.

June, 1985

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CHAPTER 1

GENERAL INFORMATION

1-1. GENERAL DESCRIPTION

1-1.1 The 1700 Series of Microwave Synthesizers provide precise signals from 2.0 GHz to 26.5 GHz, and power outputs from −100 dBm to +10 dBm. The Model 1710 has a specified upper frequency limit of 8.0 GHz. The Model 1720 has a specified upper frequency limit of 18.0 GHz. The Model 1730 has a specified upper frequency limit of 26.499 GHz. Addition of Option 01 (Downconverter) extends frequency use down to 50 MHz (10 MHz with overrange). The AM, FM, and pulse modulation features provide added versatility for testing receivers. The 1700 Series has a choice of programming languages fitted as standard. Module design permits faster servicing.

1-2. SPECTRAL PURITY

1-2.1 The indirect synthesis technique employed by Systron Donner in the Model 1700 Series yields a 0.1 Hz resolution over the entire frequency range, excellent stability, and optimum phase noise. Harmonics and spurious levels are specified over the full frequency range to be better than −50 dBc. Indirect synthesis avoids the signal degradation and resolution reduction associated with harmonic multiplying techniques.

1-3. DYNAMIC OUTPUT RANGE

1-3.1 Internal and external leveling are available as standard. Flatness and accuracy are guaranteed up to the specified +10 dBm. Significantly more power is available at most frequencies before the unit unlevels and overrange extends to −120 dBm, nominal, with a resolution of 0.1 dB. A special function selects display of commanded or measured output power on the four digit OUTPUT LEVEL readout.

1-4. MODULATION

1-4.1 AM, FM, and Pulse modulation inputs are provided. AM or Pulse modulation may be applied simultaneously with FM. Within the normal vernier range, up to 90% modulation is specified, from 100 Hz to 50 kHz rate. Over 1 MHz of FM can be generated, at rates from 100 kHz to 1 MHz. Pulse modulation provides excellent ($\geq$80 dB) on/off ratios, fast edges ($<$25 ns typical), and a minimum leveled pulse width of 200 ns. The delay from pulse input to pulsed RF output remains constant over the entire frequency range.

1-5. SWEEP CAPABILITY

1-5.1 Versatile digital step sweep allows sweep of frequency and/or level in either direction, with step size, step delay, and start/stop limits user-defined. For simultaneous frequency and level sweep, the 1700 Series automatically controls the level sweep to complete the frequency and level sweeps together. The 1700 Series phase locks and levels at each step. TTL trigger input and RF valid output enable "handshaking" during sweep.

1-6. PROGRAMMABILITY

1-6.1 All front and rear panel controls except the Edit pushbuttons and the spinwheel, line switch and external level calibration are programmable via the IEEE-488 bus using the Systron Donner 1700 Series Programming Language. The 1700 Series is also fitted with Control Interface Intermediate Language (C.I.I.L.) and may be configured to accept the Systron Donner Model 1618 Programming Language. The 1700 Series will report Instrument Fault Messages and Programming Error Messages in C.I.I.L. format, and Locked and Leveled status in Model 1618 format via the bus.

1-7. SERVICEABILITY

1-7.1 Internal diagnostics, through the use of error codes, locate most faults to easily replaceable plug-in printed circuit cards in order to reduce downtime. Further, the microwave section is designed with five separate easy to remove plug-in modules. Since most components are standard off-the-shelf items, provisioning requirements are not a problem.

1-8. SPECIFICATIONS

1-8.1 The specifications for the 1700 Series Microwave Synthesizer are listed in table 1-1.

1-9. OPTIONS

1-9.1 Options available for the 1700 Series Microwave Synthesizer are listed in table 1-2.

1-10. ACCESSORIES

1-10.1 Accessories supplied with the 1700 Series Microwave Synthesizer are listed in table 1-3.

Table 1-1. Specifications

Frequency (See paragraph 1-1, General Description)	
Frequency Ranges:	2 to 26.5 GHz (depending on model).
External Time Base:	10 MHz, 1 to 3 V rms into 1 kohms.
Frequency Resolution:	0.1 Hz, 1 kHz with Option 03.
Frequency Accuracy:	Equal to time base.
Internal Time Base:	10 MHz; aging rate is ±5 parts 10^{-10}/day.
Reference Output:	10 MHz, 2.2 V P-P level into 1 kohm.

Spectral Purity (0 dBm) (Notes 2, 4, 6)	
Harmonics and Subharmonics	−55 dBc
Spurious (CW and AM Modes) Non-harmonically related:	−50 dBc, excluding line related spurious.
Power Line Related:	60-Hz specification degrades by 5 dBc at 50 Hz.

Frequency Range (GHz)	Offset from Carrier		
	< 300 Hz	0.3 to 1 kHz	>1 kHz
0.05 to 2	−40	−50	−60
2 to 8	−40	−50	−60
8 to 18	−35	−45	−60
18 to 26.5	−30	−40	−60

Table 1-1. Specifications — Continued

Single Sideband Phase Noise	Measured in a 1-Hz noise BW, CW Mode (readings in dBc).				
Frequency Range (GHz)	Offset from Carrier				
	30 Hz	100 Hz	1 kHz	10 kHz	100 kHz
0.05 to 2	−58	−67	−85	−85	−103
2 to 8	−61	−67	−87	−87	−104
8 to 18	−54	−60	−80	−80	−97
18 to 26.5	−50	−55	−75	−75	−90

Amplitude Modulation (Note 3)	
AM Depth:	0 to 90% at level vernier setting 6 dB below maximum specified leveled output (15° to 35°C).
AM Rates (3 dB bandwidth):	100 Hz to 50 kHz.
AM Sensitivity:	1 V peak into 600 ohms nominal for 100% external modulation input.

Frequency Modulation	
Peak Deviation:	> 1 MHz (15° to 35°C).
FM Rate (3 dB bandwidth):	100 kHz to 1 MHz.
FM Sensitivity:	1 V peak for 1 MHz deviation; external input into 50 ohms nominal.

RF Output (1710: 2 to 8.0 GHz) (1720: 2 to 18.0 GHz) (1730: 2 to 26.5 GHz) (Note 3)	
Resolution:	0.1 dB.
Output Impedance (nominal)	50 ohms.
Output Level Range (Notes 2, 3, 5):	−120 to >+10 dBm (> +3 dBm for Options 4, 12). −100 to +6 dB (18 to 26.5 GHz).
Unleveled Output Power Typical (Note 4):	> +13 dBm (Option 04 +5 dBm).
Flatness and Accuracy (Notes 2, 3, 5):	±1 dB, −65 dBm < P out ≤ +10 dBm. ±2 dB, −100 dBm < P out ≤ −65 dBm.
Level Switching Time:	
Attenuator:	≤ 25 ms/step change.
Level Vernier:	≤ 10 ms/step change.

Table 1-1. Specifications — Continued

Pulse Modulation	This is an internal high-speed pulse modulator with external input.
Rise/Fall Time:	≤ 25 ns (35 ns F (<2 GHz).
Leveled Pulse Width:	200 ns — 5 ms
Pulse Repetition Rate:	100 Hz — 1 MHz (usable to 10 Hz).
Input:	TTL levels on front panel bnc connector.
Minimum Time Between Pulses:	300 ns.
On/Off Ratio:	≥ 80 dB at 0 dBm Leveled Output.
Delay (Time between 50% levels of TTL input and RF output):	300 ns nominal.
Low Frequency Output (Option 01)	This option extends the frequency range down to 50 MHz.
Frequency Range:	0.05 to 2 GHz (10 MHz underrange).
Harmonics:	≤ −40 dBc (Notes 2, 4, 6).
Spurious:	≤ −50 dBc (Notes 2, 4, 6).
Frequency Resolution:	0.1 Hz.
Level Flatness and Accuracy:	Same as standard 1700.
Output Power:	Same as standard 1700.
Remote Programming IEEE-488	
Remote Command Syntax:	Programmable using S.D. 1700 Series Programming Language, Control Interface Intermediate Language, and with Option 13, S.D. Model 1618 Programming Language.
Frequency:	Programmable in 0.1 Hz increments (1 kHz increments with Option 03), from 2 GHz (10 MHz with Option 01) to 8.999 999 9999 GHz for Model 1710, to 18.999 999 9999 for Model 1720, and to 26.999 999 9999 for Model 1730.
Output Level:	Programmable in 0.1 dB increments from −120.0 dBm to +20.0 dBm (−10.0 dBm to +20.0 dBm with Option 02) (−127.0 dBm to +13.0 dBm with Option 04 or 12) (−17.0 dBm to +13.0 dBm with Option 02 and with Option 04 or 12).

Table 1-1. Specifications — Continued

Modulation:	Permits selection of CW, Pulse, AM, and/or FM.
Mode:	Permits selection of internal or external ALC, and internal, external, or automatic selection of 10 MHz timebase.
Status Reporting:	When addressed to talk, status of leveled condition, locked condition, external modulation, internal tests, and remote programming errors. In 1618 Mode (Option 13), reports status of leveled and locked condition.
Program Execution Time, Interface Load Rate from Bus:	50 μs/character.
Program Execution Time, Data Transfer to Synthesizer:	30 ms typical (measured from receipt of Line Feed or End to RF Valid Low).
Frequency Switching Time:	$<$10 ms typical for $<$1 MHz change, 50 ms typical for $\geq$ 1 MHz change, 150 ms for Band change (measured from RF Valid Low to RF Valid High).
Digital Step Sweep Frequency and/or Level	
Sweep Function:	Frequency: Start (F1)/Stop (F2). Level: Start (P1)/Stop (P2).
Sweep Mode:	Single, Continuous, Ext Triggered Sweep (TTL input).
Step Size:	Minimum ±0.1 Hz. Maximum frequency range of unit. Minimum ±0.1 dB. Maximum power range of unit.
Step Dwell Time:	0 to 999 ms per step. (See note 7.) 0 to 2.0 sec per frequency step (except in 1618 mode — Option 13).
RF Valid:	TTL output high = RF locked and level stable. Low during frequency and/or level switching, high during step Dwell Time. Remains low if RF does not stabilize.
General	
Operating Temperature Range:	0° to 50°C (15° to 35°C for specified accuracies).
Weight:	56 lbs (23 kg); Shipping weight approximately 64 lbs (26 kg).
Power:	100/115 or 200/230 V ac ±10%, 48 to 400 Hz, 250 W.

Table 1-1. Specifications — Continued

Dimensions:	W × D × H: 17 in. (43.2 cm) × 24 in. (61 cm) × 5.25 in. (13.4 cm).
Rack Mounting:	Rack mount kit supplied with unit.
Frequency Bands (GHz):	2 to 8 (All models), 8 to 18 (1720, 1730), 18 to 26.5 (1730).
With Option 01:	0.05 to 2.0 GHz added.

NOTES:

1. Stability and spectral purity will be affected by characteristic of external reference oscillator.
2. At 0 dB step where applicable into 50 ohms in leveled mode.
3. 15° to 35°C.
4. Spurious content may degrade at power levels other than specified output.
5. Accuracy and level relative to digital output display with internal leveling.
6. Relative to carrier at specified output.
7. Fixed delay is normally 10 ms. Frequency switching time is 50 ms for 1 MHz or greater change and 150 ms for Band change.

Table 1-2. Options

Options	Description
01	Extended low frequency output (50 MHz with 10 MHz overrange).
02	RF output without attenuator.
03	Reduced resolution (1 kHz).
04	Deletes pulse modulation and reduces output power to +3 dBm.
05	RF outputs and Modulation inputs on rear panel.
06	Rack Mount.
12	+3 dBm output power.
13	1618B Language fitted.

Table 1-3. Supplied Accessories

Description	Part Number
Line Cord, 8 ft., 3 x 18 AWG, Rectangular: Qty 1	102407
Manual, Operator's: Qty 1	

CHAPTER 2

INSTALLATION

2-1. INTRODUCTION

2-1.1 This chapter outlines the procedures for initial inspection and installation of the 1700 Series. The subject matter includes receiving inspection, installation criteria, initial turn-on/confidence checks, and IEEE STD-488 General Purpose Interface Bus (GPIB) system interconnection. Instructions concerning preparation for reshipment are included at the end of this chapter.

2-2. RECEIVING INSPECTION

2-2.1 Prior to accepting the unit from the shipper, inspect the condition of the shipping container for any indication of freight damage. Any sign of such damage must be noted by both the shipper and receiver and reported to the insurance investigator.

2-2.2 Immediately following removal of the unit from the shipping carton, inspect for possible physical damage incurred during the shipment. Check surfaces for scratches or dents and note the condition of knobs and connectors. Should any damage be detected, notify your nearest Systron Donner representative — DO NOT USE THE INSTRUMENT UNTIL INSTRUCTED TO DO SO BY THE REPRESENTATIVE.

2-3. POWER REQUIREMENTS

2-3.1 The 1700 Series requires a main supply of 100/115 or 200/230 V rms, at 50 to 60 Hz. Power consumption is approximately 15 W in standby and up to 250 W when operational. Two internal connectors accept designated selector plugs to match 1700 Series to existing line voltage conditions.

WARNING

This is a Safety Class I product and, as such, is provided with a protective grounding terminal. The detachable three-conductor power cord couples this grounding terminal to the power source uninterruptible safety earth terminal. Do not use the unit if the safety ground is broken. An adapter which provides a chassis ground should be used whenever the power cord is mated to a two-terminal outlet.

2-4. LINE VOLTAGE AND FUSE SELECTION

NOTE

A label by the line input connector shows the voltage set at the factory. Do not remove covers. Broken seals will invalidate warranty.

2-4.1 Before connecting the power cord, be certain that proper voltage selector plugs and fuses are installed. Two internal connectors, J1 and J2, accept the various selector plugs, P1 and P2, to match the unit to existing line voltage conditions. See figure 2-1 for P1 and P2 wiring diagrams and table 2-1 for jumper pin and part number listings. Locations of these connectors and plugs are shown in figure 2-2.

Table 2-1. Power Line-Selector, Plugs P1 and P2

Voltage (Nominal)	Jumper Pins	Wire Color	Systron Donner Part Number
100	9-6-3, 8-4-2	Brown	07575701
115	9-6-3, 7-4-1	Red	07575702
200	6-3, 9-2, 8-4	Yellow	07575703
230	6-3, 9-1, 7-4	Blue	07575704

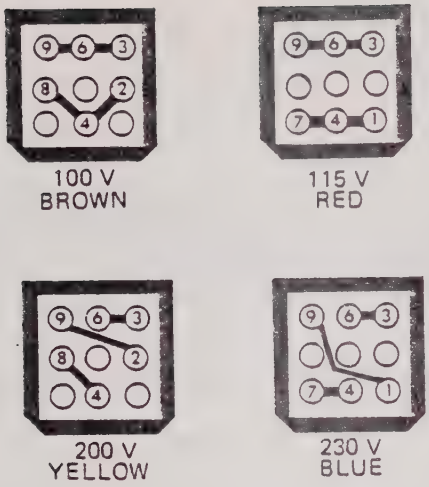

Figure 2-1. Power Line-Selector, Receptacle Top View

WARNING

The YIG drivers supply high currents through the fuse bank shown in figure 2-2. These currents can cause burns if inadvertently shorted.

2-4.2 Two external and four internal fuses protect the synthesizer from internal or external overloads. For 100/115-V operation, the synthesizer is shipped with a 0.5-A, 3 AG slow-blow fuse in the F1 fuseholder and a 2.5-A, 3 AG slow-blow fuse in the F2 fuseholder on the rear panel. Should 230-V operation be required, fuse F2 must be replaced with a 1.5-A, 3 AG slow-blow fuse, and fuse F1 replaced with a 0.25-A, 3 AG slow-blow fuse. See figure 2-2 for fuse locations and table 2-2 for fuse values.

2-5. LOCATION SITE

2-5.1 For installation purposes, an outline-dimensioned/rack-mounting diagram is provided in figure 2-3 to assist 1700 Series installation personnel. The rear panel must remain unobstructed (4"to 6" clearance) while the synthesizer is operating to allow proper cooling. Also, access to the rear panel-mounted fuseholders, GPIB interface connector signal cables, and power cord is necessary. Periodic cleaning of the air filter also requires access to the rear panel.

2-6. BENCH MOUNTING

2-6.1 The 1700 Series may be installed on a bench with clearance provided for the rear panel connectors. The air intake and exhaust ports, located on the rear panel, must remain unobstructed to allow adequate cooling of the instrument.

2-6.2 The instrument is supplied with a swing-down-type bail mounted on the front of the bottom cover. When extended, this stand will tilt-up the front panel of the 1700 Series to a comfortable viewing angle.

Table 2-2. Instrument Fuses

Reference	Description	Manufacturer/ Part Number	Systron Donner Part Number
100/115-V operation:			
F1	0.5A 3AG SB	71400/MDL0.5	100589
F2	2.5A 3AG SB	75915/31302.5	119320
230-V operation:			
F1 (alt)	0.25A 3AG SB	71400/MDL.25	100600
F2 (alt)	1.5A 3AG SB	75915/31301.5	100591

Table 2-2. Instrument Fuses — Continued

Reference	Description	Manufacturer/ Part Number	Systron Donner Part Number
Internal fuses			
A1F2	3A 3AG MB	75915/	100587
A1F3	2A 3AG MB	75915/	100581
A1F4	1A 3AG MB	75915/	100580
A1F5	1A 3AG MB	75915/	100580

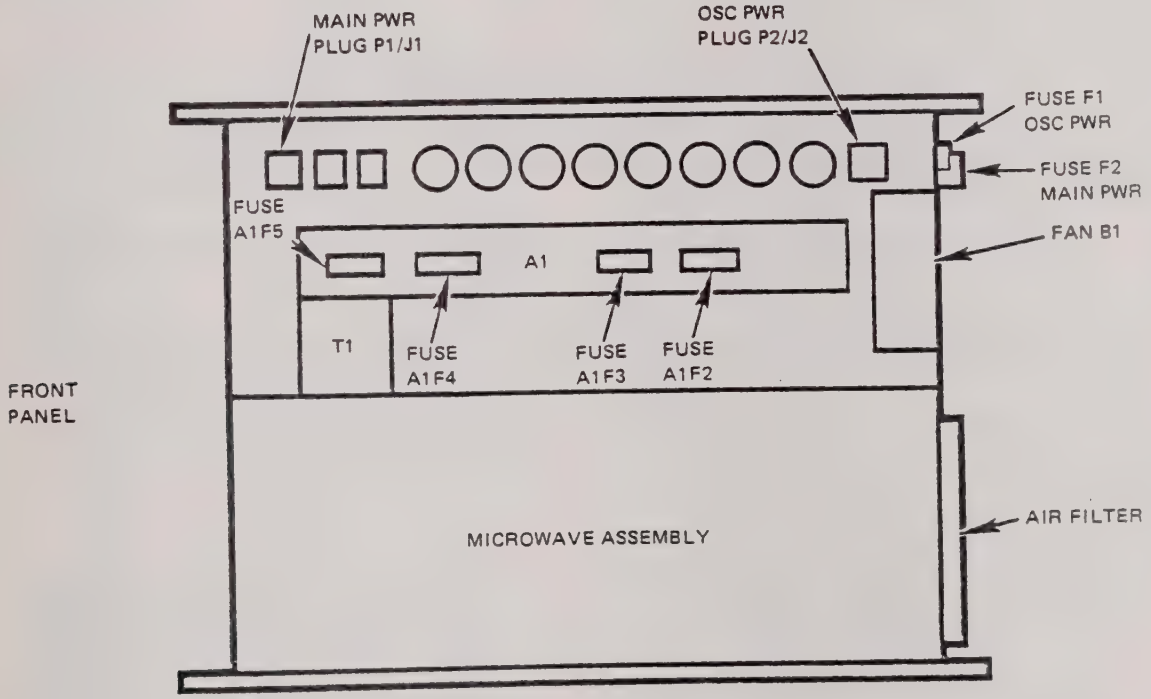

Figure 2-2. Plugs P1, P2, and Fuse Locations, 1700 Series, Top View

2-7. RACK MOUNTING

2-7.1 The instrument is shipped with two rack-mounting brackets and four 10-32 X 5/8 screws. To assemble, remove the two forward bottom-row cover screws on the right and left sides of the unit (see figure 2-3). Attach the right- and left-hand rack mounting brackets to each side of the cabinet with the supplied hardware, as shown.

WARNING

The synthesizer weighs approximately 22 kg (50 lbs). Be sure to provide adequate rack-shelf mounting for the unit and exercise care when lifting to avoid personal injury.

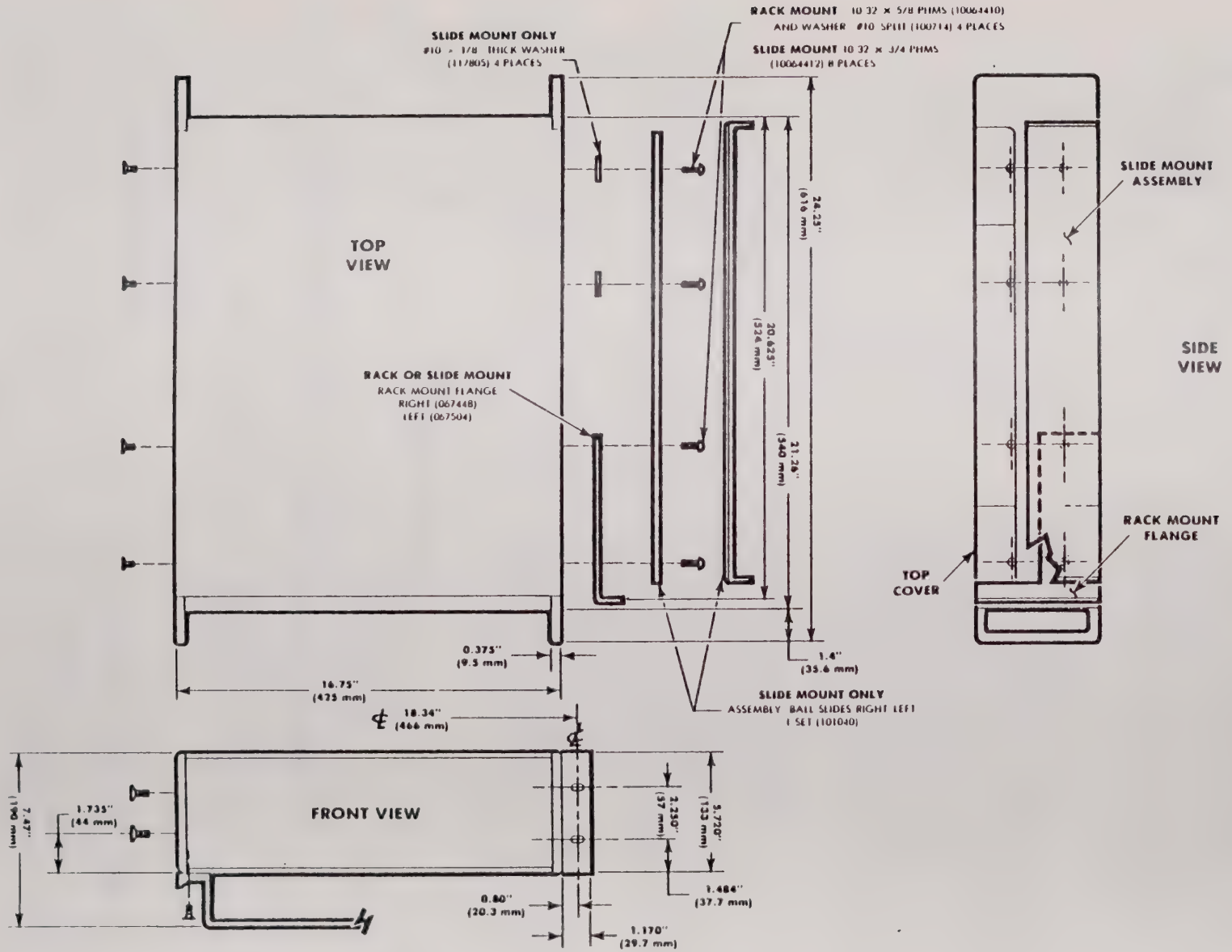

Figure 2-3. Outline Drawing and Rack/Slide Mounting Details

2-7.2 Optional equipment rack slides are recommended when rack mounting the 1700 Series. The slides are available from the factory as a standard accessory. Follow the mounting procedures shown in figure 2-3 for rack mounting, then mount the rack slides, as shown. When completed, check the installation to be certain that all top-cover mounting screws are clear for removal should servicing be required.

2-8. OPERATING ENVIRONMENT

2-8.1 The operating temperature for the 1700 Series is 0° to 50°C (15° to 35°C for specified accuracies) with a relative humidity of < 95%. The maximum altitude is < 4572 m (15,000 ft).

2-9. INITIAL TURN-ON

2-9.1 This procedure verifies that instrument damage has not occurred during transit and that the unit is operative. Prior to performing the initial turn-on procedure, become familiar with the synthesizer controls as described in tables 3-1 and 3-2.

2-9.2 Perform the following step procedures to initially check the operation of the 1700 Series:

Step 1. Check power configuration label on rear panel for the proper line-voltage operating range and connect the ac power cord to the appropriate line power source. The internal oscillator heater circuits are now energized.

NOTE

If the POWER switch is set to ON less than 30 minutes after connection of ac power, the unit may display error codes in the modulation window and flash the frequency display. This indicates an unlocked condition which is acceptable while the timebase oscillator is cold and therefore off-frequency.

Step 2. Set POWER switch to ON. The display should momentarily blank, then illuminate all LED segments. The unit should go to its preset state of 2 GHz, -110 dBm, CW. (If Option 02 if fitted, the preset state is 2 GHz, +0.0 dBm, cw.)

NOTE

It may be necessary to synchronize the frequency counter and the 1700 Series timebase.

Step 3. Attach a frequency counter to the RF OUTPUT connector. Enter 0 dBm (press [LEVEL] [0] [GHz/+dBm]) and verify the displayed OUTPUT LEVEL is 0 dBm. Select various frequencies (press [FREQ], enter data, press [GHz/+dBm] or [MHz/−dBm] or [kHz/ms], as appropriate) and verify that the counter and synthesizer indicate the commanded frequency.

Step 4. Connect an RF power meter to the RF OUTPUT connector. At frequencies within the power meter's range, verify that the output power is within ±1 dB of the commanded power.

Step 5. Connect an external sinewave generator, set for 10 kHz at 1 V peak-peak, to the MODULATION AM input connector (input impedance of 600-ohms). Press MODULATION AM pushbutton. Verify that the MODULATION display indicates approximately 50% and verify a modulated output at the RF OUTPUT connector.

Step 6. Connect the sinewave generator, set for 500 kHz at 1 V peak-peak, to the MODULATION FM input connector (input impedance is 50 ohms). Press MODULATION FM pushbutton. Verify that approximately 500 kHz deviation is indicated on the MODULATION display and at the RF OUTPUT connector.

Step 7. Connect a TTL level pulse generator to the PULSE input connector. Press MODULATION PULSE pushbutton. Verify that the rf output is pulsed.

Step 8. Verify that the STORE and RECALL functions operate correctly. Verify that the IEEE address is programmable.

Step 9. Verify that the SWEEP mode is operational.

Step 10. Verify that the RF OFF pushbutton mutes the RF OUTPUT when pressed.

Step 11. Verify that the EDIT spinwheel and up arrow/down arrow (increment/decrement) pushbuttons operate correctly when the EDIT ON pushbutton is lit.

2-10. GPIB SYSTEM CONNECTION, REMOTE PROGRAMMING

2-10.1 The General Purpose Interface Bus (GPIB) permits data bus control of the 1700 Series according to the IEEE Standard Digital Interface for Programmable Instruments (IEEE STD-488-1978).

2-10.2 To implement the GPIB, a 24-pin metric dimensioned connector is installed on the rear panel of the synthesizer.

2-10.3 A detailed description of the GPIB interface operation is given in chapter 3 of this manual. Table 2-3 provides the pin assignments for the rear panel GPIB 24-pin connector.

2-11. PREPARATION FOR RESHIPMENT

2-11.1 When the 1700 Series is to be repackaged for shipment, use the original packing materials or package in accordance with MIL-P-116 and MIL-E-17555E specifications. Repackage the instrument using the following step procedures:

Step 1. Attach an identification tag to the instrument indicating model number, serial number, name and address of instrument owner, and a summary of the service or repairs required.

Step 2. Wrap the instrument in sheets of heavy paper or plastic prior to placing it in the shipping container.

Step 3. Select a strong carton or wooden box as a shipping container.

Step 4. Use an adequate layer of shock-absorbing material on all sides of the unit. Protect the instrument front panel with additional layers of cardboard. Ensure that no movement of the assembly is evident within the container.

Step 5. Seal the shipping container with strong tape or metal bands and attach a packing list to the outside surface.

Step 6. Mark the shipping container "FRAGILE-DELICATE INSTRUMENT" and attach the appropriate handling symbols to ensure reasonable care in transit.

Step 7. Be certain that all correspondence or repair of this instrument includes the information contained on the instrument identification tag.

Table 2-3. GPIB Interface Connector

Pin Number	IEEE STD-488 Mnemonic
1	DI01
2	DI02
3	DI03
4	DI04
5	EOI
6	DAV
7	NRFD
8	NDAC
9	IFC
10	SRQ
11	ATN
12	GND (Shield)
13	DI05
14	DI06
15	DI07
16	DI08
17	REN
18	GND (Return for 6)
19	GND (Return for 7)
20	GND (Return for 8)
21	GND (Return for 9)
22	GND (Return for 10)
23	GND (Return for 11)
24	GND (Logic)

Table 2-3. GPIB Interface Connector — Continued

LEVELS:
TTL compatible, true (1) state is 0.0 to +0.8 V dc; false (0) state is +2.5 to +5.0 V dc.

MATING CONNECTOR:
Amphenol 57-30240.

MATING CABLES:
IEEE STD-488 Cable — 1 meter length
SD No. 11707601.
IEEE STD-488 Cable — 2 meters length
SD No. 11707602.
IEEE STD-488 Cable — 3 meters length
SD No. 11707603.

CHAPTER 3

OPERATION

3-1. INTRODUCTION

3-1.1 This chapter describes the operation of the 1700 Series Microwave Synthesizer both as a stand-alone instrument (manual or local operation) and as part of an automatic testing system (remote operation). Simultaneous use of instrument functions will be noted. Included is a tabular description of each of the front and rear panel controls, connectors, and indicators.

3-2. FRONT PANEL CONTROLS, CONNECTORS, AND INDICATORS

3-2.1 The various controls, connectors, and indicators on the front panel of the 1700 Series are shown in figure 3-1. Each of the indexed items is described in table 3-1.

3-3. REAR PANEL CONTROLS AND CONNECTORS

3-3.1 The various controls and connectors on the rear panel of the 1700 Series are indexed and shown in figure 3-2. Each of the indexed items is described in table 3-2.

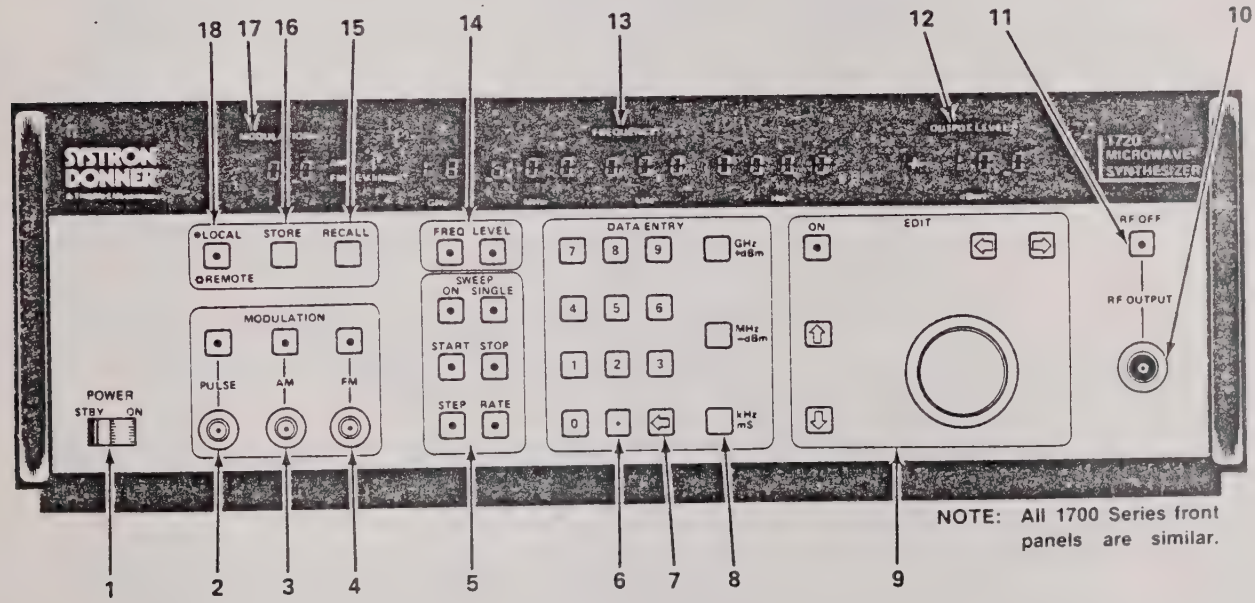

Figure 3-1. Front Panel, 1700 Series

Table 3-1. Front Panel, 1700 Series

Index	Control, Indicator, or Connector	Function
1	POWER STBY/ON switch	Supplies main power to the synthesizer circuits when in the ON position. In the STBY position, power is maintained to the internal oscillator heater circuits.
2	MODULATION PULSE pushbutton and connector	Pushbutton enables/disables PULSE input connector. When pushbutton is lit, input connector accepts a TTL signal for pulse modulation of the RF OUTPUT signal.

Table 3-1. Front Panel, 1700 Series — Continued

Index	Control, Indicator, or Connector	Function
		TTL High turns RF on. May be used simultaneously with FM modulation. Edge triggered.
3	MODULATION AM pushbutton and connector	Pushbutton enables/disables AM input connector. When pushbutton is lit, the 600-ohm input peak-peak connector accepts DC to 100 kHz signals 2 V (maximum) providing nominal 100% depth (90% specified maximum). May be used simultaneously with FM modulation.
4	MODULATION FM pushbutton and connector	Pushbutton enables/disables FM input connector. When pushbutton is lit, the 50-ohm input connector acceps 100 kHz to 1 MHz signals ±1 V peak (maximum) providing ±1 MHz deviation. May be used simultaneously with either AM modulation or PULSE modulation.
5	SWEEP parameter pushbuttons	Pushbuttons select sweep parameters to be entered as follows: SWEEP ON — turns on sweep. Triggers single sweep when SWEEP SINGLE pushbutton is lit. SWEEP SINGLE — when activated (lit), allows one sweep per set parameters to be triggered by SWEEP ON pushbutton. SWEEP START pushbuttons — when activated (lit), allows entry of starting frequency or level from DATA ENTRY pushbuttons. SWEEP STOP pushbutton — when activated (lit), allows entry of stopping frequency or level from DATA ENTRY pushbuttons. SWEEP STEP pushbutton — when activated (lit), allows entry of step size of frequency or level from DATA ENTRY pushbuttons. SWEEP RATE pushbutton — when activated (lit), allows entry of delay at each step from DATA ENTRY pushbuttons.
6	DATA ENTRY numeric pushbuttons	These pushbuttons are used to input numeric data in conjunction with SWEEP parameter pushbuttons, parameter entry pushbuttons, and EDIT pushbuttons and spinwheel.
7	DATA ENTRY correction pushbutton (left arrow)	Used as a "backspace" to delete an unwanted keystroke.

Table 3-1. Front Panel, 1700 Series — Continued

Index	Control, Indicator, or Connector	Function
8	DATA ENTRY terminator pushbuttons	Used in conjunction with SWEEP parameter pushbuttons, DATA ENTRY numeric pushbuttons, and parameter entry pushbuttons to complete data entry. (Note: A terminator is required before unit will update. Invalid data cannot be terminated.)
9	EDIT pushbuttons and spinwheel	Four pushbuttons and spinwheel used in conjunction with DATA ENTRY numeric pushbuttons to update inputted data. EDIT ON — enables/disables edit functions. EDIT left/right pushbuttons — moves the edit cursor signified by a flashing digit left or right within the parameter selected for editing. EDIT up/down pushbuttons — increments or decrements selected digit. EDIT spinwheel — allows rapid modification of selected digit.
10	RF OUTPUT connector	Provides front panel output.
11	RF OFF pushbutton	Turns off rf output when lit.
12	OUTPUT LEVEL display	Seven-segment, 3½-digit display indicates output power at RF OUTPUT connector. During data entry, the display indicates start and stop sweep levels, step size, and rate. Also indicates an unleveled condition by flashing all digits. (Note: Rate and step size set automatically by unit during simultaneous frequency and level sweeps.)
13	FREQUENCY display	Seven-segment, 12-digit display indicates frequency at RF OUTPUT connector. During data entry, the display indicates start and stop sweep frequencies, step size, and rate. Also used to indicate an unlocked condition, e.g., all 12 digits flashing and special functions, e.g. IEEE address.
14	Parameter Entry selection	Two pushbuttons used to select entry of frequency or level data in conjunction with DATA ENTRY pushbuttons. FREQ pushbutton — when lit, allows entry of frequency data and/or sweep per frequency data as entered. LEVEL pushbutton — when lit, allows entry of level data.

Table 3-1. Front Panel, 1700 Series — Continued

Index	Control, Indicator, or Connector	Function
15	RECALL pushbutton	Enables recall of previously stored front panel settings. (Press [RECALL] then enter memory number 0 through 9.)
16	STORE pushbutton	Enables storage of up to ten complete front panel settings, including sweep parameters. (Press [STORE] then enter memory number 0 through 9.)
17	MODULATION display	Seven-segment, 3-digit display indicates FM deviation in kHz (displayed without a decimal point) and AM depth in percent (displayed with a decimal point). During simultaneous AM and FM modulation, the display indicates the most recently selected. Also used to indicate error codes generated by internal diagnostics.
18	LOCAL/REMOTE pushbutton	Releases instrument from remote programmed operation unless local lockout is set. Also displays IEEE address when pressed under local control. Press [LOCAL] to view current address. For change of address, enter new address, then press any DATA ENTRY terminator pushbutton. LED lit indicates remote operation.

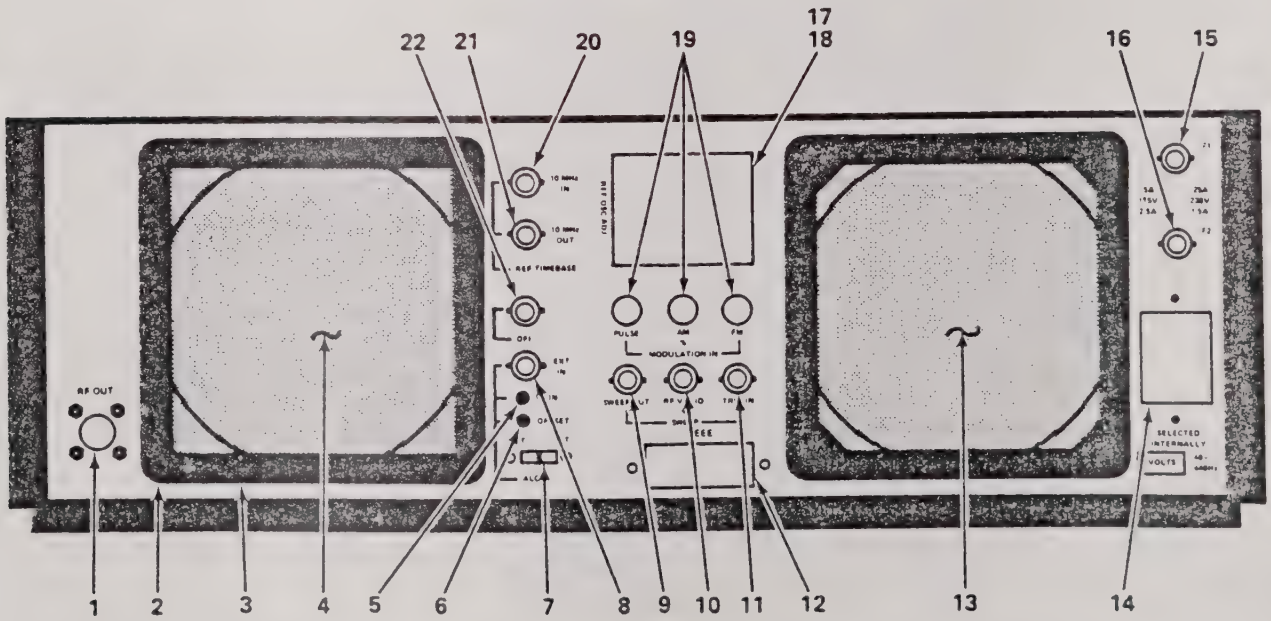

Figure 3-2. Rear Panel, 1700 Series

Table 3-2. Rear Panel, 1700 Series

Index	Control or Connector	Function
1	RF OUT	Provides the rf output when rear output option is fitted.
2	Hex Nut	One of four mounting nuts that attach the air filter housing to the rear panel.
3	Air Filter Housing	Housing holds the air filter and is held on with four mounting nuts.
4	Air Filter	Metal air filter screen must be cleaned periodically. DO NOT OBSTRUCT AIR FLOW THROUGH THIS PORT.
5	ALC GAIN (recessed screwdriver control)	Adjusts automatic leveling control gain when using an external detector.
6	ALC OFFSET (recessed screwdriver control)	Adjusts automatic leveling control offset when using an external detector.
7	ALC, EXT-IN (slide switch)	Selects either internal or external automatic leveling control.
8	EXT ALC IN (BNC connector)	Connector accepts the leveling voltage from an external detector when in the EXT ALC mode.
9	SWEEP OUT (BNC connector)	Connector provides a sweep output signal: 0 to 10 volts (0 volts at start of sweep to 10 volts at end of sweep).
10	SWEEP RF VALID (BNC connector)	Connector provides a TTL RF VALID signal output when output is locked and leveled and RF is turned on.
11	TRIG IN (BNC connector)	Connector accepts a TTL level step sweep trigger.
12	IEEE (24-pin connector)	Connector interfaces the instrument to GPIB IEEE STD-488-compatible equipment to permit remote programming of the unit.
13	Air Exhaust (Fan)	Exhaust fan removes warm air from instrument cabinet. DO NOT OBSTRUCT AIR FLOW THROUGH THIS PORT.
14	Power Cord (receptacle connector)	Receptacle accepts the detachable power cord.
15	F1 osc power (fuse holder)	Holder retains protective fuse for the power main to the oscillator heaters. Push cap in and rotate to remove fuse.
16	F2 main power (fuse holder)	Holder retains protective fuse for the power main to the entire unit. Push cap in and rotate to remove fuse.
17	FREQ. ADJ. FINE (control access)	Screwdriver fine adjustment for setting the reference oscillator to >1 part in 10^8.

Table 3-2. Rear Panel, 1700 Series — Continued

Index	Control or Indicator	Function
18	FREQ. ADJ. COARSE (control access)	Screwdriver coarse adjustment for setting the reference oscillator to >1 part in 10^6.
19	MOD IN FM (BNC connector)	When rear input option is applied, connector accepts a 50 kHz to 1 MHz signal, 1 V peak-peak into 50 Ω , to modulate RF OUT signal from 0 to 1 MHz maximum deviation.
	MOD IN, AM (BNC connector)	When rear input option is applied, connector accepts a DC to 100 kHz signal 0 to 1 V peak-peak into 600 Ω for amplitude modulating the RF OUT signal.
	MOD IN, PULSE MOD	When rear input option is applied, connector accepts a TTL signal for pulse modulating the RF OUT signal.
20	10 MHz IN (BNC connector)	Accepts a 1 to 3 V rms into 1 kΩ 10 MHz signal for use as the reference. Switching from the internal reference to the external reference is automatic.
21	10 MHz OUT (BNC connector)	Connector provides a 10 MHz reference output at 2.2 V p-p into 1 kΩ.
22	DFI	Discrete Fault Indicator Connector. 1 — 2 MHz input (1720-S6002).

3-4. LOCAL (MANUAL) OPERATING PROCEDURES

3-4.1 After installation of the instrument per Chapter 2 of this manual, connect the ac power cord to the rear panel power receptacle and an appropriate power source.

NOTE

Before operating the instrument, review the functions of the controls, connectors, and indicators and specifications of the instrument. See paragraphs 1-8, 3-2, and 3-3.

3-4.2 Allow 30 minutes for warm-up of the oscillator circuits, then set the POWER switch to ON. The display should momentarily blank, then illuminate all LED segments. The instrument will go to its preset state of 2 GHz and −110 dBm, Carrier Wave (CW) or if Option 02 is fitted, to a preset state of 2 GHz and +0.0 dBm, CW.

NOTE

If the POWER switch is set to ON less than 30 minutes after connection of ac power, the unit may display error codes in the modulation window and flash the frequency display. This indicates an unlocked condition which is acceptable while the timebase oscillator is cold and therefore off-frequency.

3-4.3 Frequency Selection. To enter a frequency, press [FREQ] pushbutton. The pushbutton LED indicator will light. A frequency may now be entered using the DATA ENTRY pushbuttons. Terminate (enter the frequency) by pressing the appropriate DATA ENTRY terminator pushbutton [GHz/+dBm], [MHz/−dBm], or [kHz/ms]. The new frequency will not be recognized by the instrument unless a DATA ENTRY terminator is pressed. An existing frequency may also be adjusted (edited) through the use of the

EDIT pushbuttons and spinwheel (see paragraph 3-4.9).

3-4.4 Level Selection. To enter an RF output level, press [LEVEL] pushbutton. The pushbutton LED indicator will light. An RF output level may now be entered using the DATA ENTRY pushbuttons. Terminate (enter the RF output level) by pressing the appropriate DATA ENTRY terminator pushbutton [GHz/+dBm] or [MHz/−dBm]. The new RF output level will not be recognized by the instrument unless a DATA ENTRY terminator is pressed. An existing RF output level may also be adjusted (edited) through the use of the EDIT pushbuttons and spinwheel (see paragraph 3-4.9).

3-4.5 Sweep Programming. Select parameter to be programmed [FREQ] or [LEVEL]. Select the SWEEP parameters: start/stop limits [START]/[STOP], step size ([STEP]), and delay per step ([RATE]). As each SWEEP parameter is selected (the pushbutton LED will light), enter the required value using the DATA ENTRY pushbuttons. Terminate (enter the value) each entry by pressing the appropriate DATA ENTRY terminator pushbutton ([GHz/+dBm], [MHz/−dBm], or [kHz/ms]). Existing SWEEP parameters may also be adjusted (edited) through the use of the EDIT pushbuttons and spinwheel (see paragraph 3-4.9). Pressing SWEEP [ON] (pushbutton LED will light) sets the instrument to automatic recurring sweeps within the limits of the entered SWEEP parameters. Pressing SWEEP [SINGLE] (pushbutton LED will light) sets the instrument to one sweep of the entered SWEEP parameters each time SWEEP [ON] is pressed.

3-4.6 Simultaneous Sweep Programming. For simultaneous level and frequency sweep, the number of level steps and step size will be adjusted by the instrument to synchronize the sweep finish times. The delay per step (sweep speed) in simultaneous sweep programming is governed by the frequency sweep [RATE] entry. Enter the SWEEP parameters for a frequency sweep, then display (or enter) the level sweep start or stop limits. Both [FREQ] and [LEVEL] pushbutton LEDs should be lit. Pressing SWEEP [ON] (pushbutton LED will light) sets the instrument to automatic recurring sweeps within the limits of the entered SWEEP parameters. Pressing SWEEP [SINGLE] (pushbutton LED will light) sets the instrument to one sweep of the entered SWEEP parameters each time SWEEP [ON] is pressed.

3-4.7 Modulation. Select the modulation required and connect a signal generator to the appropriate BNC connector. Press the modulation pushbutton [PULSE], [AM], or [FM]. The RF OUTPUT signal has the appropriate modulation as indicated on the MODULATION DISPLAY. For multiple modulations (AM and FM or PULSE and FM) connect signal generators as required and press both pushbuttons, either (AM) and (FM) or (PULSE) and (FM). (NOTE: PULSE and AM may not be used simultaneously.) The modulation display indicates AM or FM, whichever was most recently selected.

3-4.8 Automatic Level Control (ALC) Selection. If the leveling of the RF OUTPUT signal is to be done internally, select INT with the rear panel ALC switch. If an external leveling device, i.e. a negative output diode detector, is used, select EXT with the rear panel ALC switch and connect the external level detector output to the EXT ALC IN connector on the rear panel. Next select the output level attenuation, modulation, and reference desired. Adjust ALC GAIN and OFFSET controls as required for calibration.

3-4.9 Editing. To edit a digit, press the [EDIT ON] pushbutton which will light to indicate active edit mode. Select the parameter to be edited from the parameter pushbuttons [FREQ] or [LEVEL] and/or SWEEP parameter pushbuttons. Move the cursor, signified by a flashing digit, to the position to be edited with the left/right arrow pushbuttons. (The cursor will roll around within the chosen display section.) Increment or decrement as required using the EDIT spinwheel, up/down arrow pushbuttons, or enter data directly from the DATA ENTRY numeric pushbuttons. Edit must be turned off to enter complete new data strings.

3-4.10 Storage of Instrument Front Panel Settings. The 1700 Series Microwave Synthesizers contain battery backed up Random Access Memory (RAM). This RAM, contained on the A2 printed circuit board, is used for the storage of front panel settings, IEEE-STD-488 GPIB address, and configuration data for the 1618 GPIB mode. Upon entry of instrument settings, the operator may store these settings by pressing [STORE] pushbutton then entering a single digit (0 thru 9) using the DATA ENTRY pushbuttons. This storage ability allows the operator to store up to ten different front panel settings. To recall a desired setting the operator presses the [RECALL] pushbutton and enters the appropriate digit (0 through 9). The instrument will then return to the settings previously stored at that memory number.

3-4.11 10 MHz Reference Input. To reference the synthesizer to an external 10 MHz high stability oscillator, connect the external reference signal with a minimum of 1 V rms into 1 kilohm to the rear panel REF TIMEBASE 10 MHz IN BNC connector. Selection from the internal timebase to the external reference is automatic when a signal is present at the REF TIMEBASE 10 MHz IN BNC connector. If the external signal is interrupted, the synthesizer automatically returns to the internal reference oscillator.

3-4.12 10 MHz Reference Output. The REF TIMEBASE 10 MHz OUT BNC connector is on the rear panel. The internal reference oscillator output signal is nominally 2.2 V peak-peak into 1 kohm.

3-4.13 Instrument Error Codes. The 1700 Series uses internal diagnostics to verify correct operation. Should the internal diagnostics detect an error, an error code will be displayed in the modulation display. This error code will consist of the letter "E" and a two-digit number. The number relates to the assembly generating the error. See table 3-3 for a listing of error code versus assembly. When in remote operation, the error messages are outputted on the GPIB. (See paragraph 3-20).

3-5. REMOTE OPERATION

3-5.1 The 1700 Series may be remotely operated using the General Purpose Interface Bus (GPIB). This interface permits control and status reporting of the instrument from a data bus that conforms to IEEE-STD-488. In the remote mode (instrument is connected to the interface bus and commanded to remote), the instrument may be programmed by sending device dependent commands during the instrument's "listen" mode of operation. Device dependent commands and interface commands are received by the instrument at anytime during its operation. The instrument will ignore any interface command which it has not been designed or programmed to recognize. When the instrument is addressed to "talk", data is transferred in compliance with IEEE-STD-488 "handshake" process to those devices that are addressed to "listen".

3-5.2 IEEE-STD-488 implemented interface function subsets are listed in Table 3-4.

Table 3-3. 1700 Series Error Codes Versus Assemblies

1700 Series Error Code	Associated Assembly	Error Description
E2.0	A2	RAM failure
E2.1	A2	PROM failure
E2.2	A2	EEPROM failure
E2.3	A2	Time failure
E3	A3	Unleveled
E8	A8	Fixed Local Oscillator Unlocked (Downconverter only)
E10	A10	Divide by N unlocked
E11	A11	Reference Synthesizer unlocked
E12	A12	Timebase VCXO unlocked
E13	A13	Output PLL unlocked
E14	A14	Reference PLL unlocked

Table 3-4. Implemented Interface Function Subsets

Subset	Description	Capability
SH1	Source Handshake	Complete
AH1	Acceptor Handshake	Complete
T6	Talker	Basic Talker, Serial Poll, Unaddressed in MLA

Table 3-4. Implemented Interface Function Subsets — Continued

Subset	Description	Capability
TE0	Extended Talker	None
L4	Listener	Listen, Basic Listener, Un-addressed if MTA
LE0	Extended Listener	None
SR1	Service Request	Complete
RL1	Remote Local	Local lock out, return to local from keyboard
PP0	Parallel Poll	None
DC1	Device Clear	Complete
DT0	Device Trigger	None
C0	Controller	None

3-6. IEEE ADDRESS ASSIGNMENT PROCEDURE

3-6.1 Any of thirty-one (31) IEEE addresses may be assigned to set the talk and listen addresses for the 1700 Series instruments. See table 3-5 for address settings and corresponding listen/talk ASCII characters.

3-6.2 To enter the IEEE address, press the [LOCAL/REMOTE] pushbutton. The FREQUENCY display will indicate "IEEE" and the current address. Enter the desired address as a decimal number (0 through 30) from table 3-4 using the DATA ENTRY pushbuttons, then press any DATA ENTRY terminator pushbutton. The IEEE address is now stored in the battery backed-up RAM and in the Address Register of the GPIB Interface Adapter chip. This address will remain set until a new address is entered, even if AC power is disconnected.

3-6.3 To address the instrument's talk or listen capability, couple a IEEE-STD-488 24-pin cable to the rear panel IEEE connector. Program the controller to set ATN line to 1, and send UNL (unlisten) COMMAND TO INHIBIT ALL CURRENT LISTENERS. Now, send the listener or talk address

Table 3-5. Talk/Listen Address vs ASCII Character

Dec No.	ASCII Character	
	Listen	Talk
0	SP	@
1	!	A
2	"	B
3	#	C
4	$	D
5	%	E
6	¢	F
7	'	G
8	(	H
9	)	I
10	*	J
11	+	K
12	,	L
13	-	M
14	.	N
15	/	O
16	0	P
17	1	Q
18	2	R
19	3	S
20	4	T
21	5	U
22	6	V
23	7	W
24	8	X
25	9	Y
26	:	Z
27	;	[
28	<	\
29	=	]
30	>	^

of the instrument. When ATN goes to 0, the instrument will listen or talk. To program a new talker or listener, set the ATN line to 1 again, and send UNL and the new talk or listen address.

3-7. GPIB CHARACTERISTICS

3-7.1 For GPIB electrical and mechanical specifications, see the referenced IEEE standard. The interface system contains a set of 16 signal lines to carry all interface messages and device-dependent messages. These messages may be coded on one, or a set of signal lines, determined by the particular message content.

3-7.2 The bus structure consists of three sets of signal lines:

1. Data Bus — signal lines.

2. Data Byte Transfer Control Bus — 3 signal lines.

3. General Interface Management Bus — 5 signal lines.

3-7.3 The mnemonics, DI01 to DI08, are assigned by IEEE-STD-488 to 8 data input/output lines. Message bytes are transferred on the DI0 signal lines in a bit-parallel, byte-serial format, asynchronously, and usually bidirectionally.

3-7.4 A set of 3 interface signal lines affect transfer of each byte of data on DI0 signal lines, from an addressed talker to all addressed listeners:

1. DAV (Data Valid) indicates condition (availability and validity) of information on DI0 signal lines.

2. NRFD (Not Ready For Data) indicates the readiness condition of device(s) to accept data.

3. NDAC (Not Data Accepted) indicates the condition of acceptance of data by device(s).

3-7.5 The DAV, NRFD and NDAC signal lines operate in what is called a 3-wire (interlocked) handshake process to transfer each data byte across the interface.

3-7.6 Five interface signal lines are used to manage an orderly flow of information across the interface.

1. ATN (ATteNtion) specifies how data on DI0 signal lines are to be interpreted and which devices must respond to the data.

2. IFC (InterFace Clear) resets the interface system, portions of which are contained in all interconnect devices, into a known quiescent state.

3. SRQ (Service ReQuest) is used by a device to indicate the need for attention and to request an interruption of the current sequence of events.

4. REN (Remote ENable) is used (in conjunction with other messages) to select between two alternate sources of device programming data.

5. EOI (End Or Identify) indicates the end of a multiple-byte transfer sequence or, in conjunction with ATN, the execution of a polling sequence.

3-8. REMOTE OPERATING COMMANDS

3-8.1 The 1700 Series of instruments are remotely controlled by the entry of Systron Donner 1700 Series Language, MATE Control Interface Intermediate Language (C.I.I.L), or Systron Donner Model 1618 Language (Option 13) commands.

3-8.2 At power-up the 1700 Series instruments are in the 1700 Series Language mode of operation, or can be configured to be in the Model 1618 mode of GPIB operation. While in the 1700 Series Language mode, the 1700 Series instruments will switch automatically to the C.I.I.L. mode when a C.I.I.L. command is received.

3-8.3 Refer to Specification 2806763 Rev B, MATE System Control Interface specification, for detailed information on C.I.I.L.

3-8.4 The 1618 mode of GPIB operation (Option B) allows GPIB controller Software Programs written for the Systron Donner Model 1618 Microwave Synthesizer to be used with the 1700 Series Microwave Synthesizers. While in the 1618 Mode, the instrument will recognize all the 1618 Device Commands, the Device Clear initializes all the settings to the 1618's default setup, and the GPIB output of the lock and level status will be in 1618 format. Refer to paragraph 3-10 on Special Functions for how to configure the instrument for the 1618 mode.

3-8.5 Programming Commands. The general syntax of a command for any language mode as recognized by the instrument is a command followed by the argument(s). Each command and argument can be separated by zero or more spaces. The command can be followed by more commands. The instrument will process the command(s) when it receives a line feed, or if the GPIB controller asserts End-or-Identify when sending the last character.

3-9. 1700 SERIES PROGRAMMING LANGUAGE

3-9.1 The 1700 Series Programming Language consists of commands that correspond to the front panel controls, and of Special Functions that are accessed from the front panel by entering the Special Function number (see table 3-7).

3-9.2 The 1700 Series programming commands listed with the argument "(num. val.)" will accept integer, signed integer, or floating point type formats. Any leading spaces are ignored. The following are examples of the value one million that would be accepted.

```
  1000000
 +1000000.0
  1E6
 +1.000000E+6
  .001E+9
```

3-9.3 See table 3-6 for a listing of front panel commands cross-indexed to the remote programming commands.

Table 3-6. 1700 Series Programming Commands and Front Panel Operation Comparison

1700 Series Function	Front Panel Operation	1700 Series Programming Command	Description
Frequency	FREQ (digit) . . . (units)	FREQ (num. val.)	Set the frequency. The programming command numeric value is in Hertz.
RF Output	LEVEL (digit) . . . (+dBm/−dBm)	LEVEL (num. val.)	Set the level. The programming command numeric value is in dBm.
	RF ON	RF (ON/OFF)	RF output on or off.
	ALC EXT-INT (on rear panel)	ALC (EXT/INT)	Selects External or Internal Level Detector for the Automatic Level Control.
Modulation	PULSE	PULSE (ON/OFF)	Pulse Modulation on or off.
	AM	AM (ON/OFF)	Amplitude Modulation on or off.
	FM	FM (ON/OFF)	Frequency Modulation on or off.
Sweep Control	SWEEP ON	SWEEP (ON/OFF)	Sweep turned on or off.
	SINGLE	SWEEP (SNGL/CONT)	Single sweep or continuous sweep. Also cancels special function no. 42.
	STEP	STEP <cr><lf>	The command to step the sweep when in the manual step mode and the sweep is on.

Table 3-6. 1700 Series Programming Commands and Front Panel Operation Comparison — Continued

1700 Series Function	Front Panel Operation	1700 Series Programming Command	Description
	FREQ	SWEEP FREQ	Sweep the frequency. The FREQ pushbutton indicator LED is on and the LEVEL pushbutton indicator LED is off.
	LEVEL	SWEEP LEVEL	Sweep the level. The LEVEL pushbutton indicator LED is on and the FREQ pushbutton indicator LED is off.
	FREQ (START/STOP/ STEP/RATE) LEVEL or LEVEL (START/ STOP) FREQ	SWEEP BOTH	Sweep both the frequency and level. Both the FREQ and LEVEL pushbutton indicator LEDs are on. Front panel selection of sweep both frequency and level is implied by displaying or entering the frequency start, stop, step, or rate parameters, and the displaying or entering level start or stop.
Frequency Sweep Parameters	FREQ START (digit) . . . (units)	FREQ START (num. val.)	Set the sweep start frequency. The programming command numeric value is in Hertz.
	FREQ STOP (digit) . . . (units)	FREQ STOP (num. val.)	Set the sweep stop frequency. The programming command numeric value is in Hertz.
	FREQ STEP (digit) . . . (units)	FREQ STEP (num. val.)	Set the frequency stop size for frequency sweep or both frequency and level sweep. The programming command numeric value is in Hertz.
	FREQ RATE (digit) . . . ms	FREQ RATE (num. val.)	Set the frequency sweep rate for frequency sweep or both frequency and level sweep. The programming command numeric value is in seconds and is the time delay for each step.

Table 3-6. 1700 Series Programming Commands and Front Panel Operation Comparison — Continued

1700 Series Function	Front Panel Operation	1700 Series Programming Command	Description
RF Level Sweep Parameters	LEVEL START (digit) . . . (+dBm/−dBm)	LEVEL START (num. val.)	Set the sweep start level. The programming command numeric value is in dBm.
	LEVEL STOP (digit) . . . (+dBm/−dBm)	LEVEL STOP (num. val.)	Set the sweep stop level. The programming command numeric value is in dBm.
	LEVEL STEP (digit) . . . (+dBm/−dBm)	LEVEL STEP (num. val.)	Set the level sweep step size. The programming command numeric value is in dB and its sign is ignored.
	LEVEL RATE (digit) . . . ms	LEVEL RATE (num. val.)	Set the level sweep rate by setting the time delay for a step. The programming command numeric value is in seconds.
Miscellaneous	STORE (digit)	STOR (digit)	Stores synthesizer's setup into one of 10 non-volatile storage registers, which are numbered from 0 to 9. The 10 storage registers are in the battery backed-up RAM on the A2 board.
	RECALL (digit)	RECL (digit)	Recalls synthesizer's setup from one of 10 non-volatile storage registers.

3-10. SPECIAL FUNCTIONS

3-10.1 This paragraph describes the front panel and GPIB operation of Special Functions implemented in the 1700 Series Microwave Synthesizer.

3-10.2 Special Functions perform operations that are provided by the microprocessor firmware but do not have dedicated front panel controls. The Special Functions that are provided include configuring for the 1618 Mode of GPIB operation, direct control of the Level Attenuator and Vernier, and Sweep Trigger Option Selection.

3-10.3 Local (Front Panel) Operation. Pressing [RECALL] pushbutton and then the DATA ENTRY [Decimal Point] pushbutton will display "SF" and the synthesizer model number of "1618" if configured for the 1618 mode of GPIB operation.

3-10.4 To enable a Special Function, press [RECALL] pushbutton, the DATA ENTRY [Decimal Point], one to four digits, and then any DATA ENTRY terminators. The Special Function number entered must not include any extra leading or trailing zeros in order to be recognized as being valid. See table 3-7, Special Functions.

3-10.5 Table of Special Functions. Table 3-7 lists the Special Functions with their descriptions, front panel key presses, and programming commands.

Table 3-7. Special Functions

1700 Series Function	Front Panel Operation	1700 Series Programming Command	Description
Initialization	RECALL (dec. pt.) 0 (units)	SPC 0	Disables display of measured level. Clears the 1618 GPIB mode configuration register in battery backed-up RAM.
Display Control	RECALL (dec. pt.) 10 (units)	SPC 10	Enables display of measured level. Turned off by Special Function 0. Also turned on by 1618 command for split control of attenuator and vernier.
Level Control	RECALL (dec. pt.) 30 (units) (digit) . . . (+dBm/−dBm)	ATTN (num. val.)	Set the attenuator. The programming command numeric value is in dB. The sign is always ignored. The key presses given cause the attenuator settings to be displayed and then changed. The EDIT keys can also be used. This is equivalent to the Split-Mode available in the 1618 GPIB mode. Cancelled by pressing [LEVEL] pushbutton or using LEVEL command.
	RECALL (dec. pt.) 31 (units) (digit) . . . (+dBm/−dBm)	VERN (num. val.)	Set the vernier DAC. The programmed command numeric value is in dBm. The key presses given cause the vernier DAC setting to be displayed and then changed. The EDIT keys can also be used. This is equivalent to the Split-Mode available in the 1618 GPIB Mode. Cancelled by pressing [LEVEL] pushbutton or using LEVEL command.
Sweep Control	RECALL (dec. pt.) 40 (units)	TRIG POS	Select positive slope for rear panel sweep trigger input. This is equivalent to "X1" command in the 1618 GPIB mode.

Table 3-7. Special Functions — Continued

1700 Series Function	Front Panel Operation	1700 Series Programming Command	Description
	RECALL (dec. pt.) 41 (units)	TRIG NEG	Select negative slope for rear panel sweep trigger input. This is equivalent to "X0" command in the 1618 GPIB mode.
	RECALL (dec. pt.) 42 (units)	SWEEP TRIG	The rear panel sweep trigger input will start a single sweep. This is equivalent to "Y1" command in the 1618 GPIB mode. Selecting Single or Continuous Sweep will cancel.
	RECALL (dec. pt.) 43 (units)	STEP AUTO	The step is stepped automatically after the time delay set by the frequency rate or level rate front panel entry or programming commands. This is equivalent to "Z0" command in the 1618 GPIB mode.
	RECALL (dec. pt.) 44 (units)	STEP TRIG	The rear panel sweep trigger input will step the sweep. This is equivalent to "Z1" command in the 1618 GPIB mode.
	RECALL (dec. pt.) 45 (units)	STEP MAN	The sweep is stepped manually by the STEP pushbutton or upon receiving "STEP<cr><lf>". This is equivalent to "Z2" command in the 1618 GPIB mode.
Reference Time Base Control	RECALL (dec. pt.) 50 (units)	REF AUTO	The reference time base is automatically selected. If an external reference is present at the rear panel connector, then it is used instead of the internal reference.

Table 3-7. Special Functions — Continued

1700 Series Function	Front Panel Operation	1700 Series Programming Command	Description
	RECALL (dec. pt.) 51 (units)	REF INT	The internal reference time base is selected.
	RECALL (dec. pt.) 52 (units)	REF EXT	The external reference time base is selected. If an external reference is not present at the rear panel connector, the external time base not present message is generated, and the reference time base control goes to the automatic selection mode.
GPIB Operation	n.a.	SRQ 0	Disables generation of a service request on the GPIB.
	n.a.	SRQ 1	Enables generation of a service request on the GPIB when there is any abnormal operation detected and there is an error message waiting to be output. This feature is off at power up and after doing a device clear.
	n.a.	1618	Go to 1618 mode. Use when switching from the 1700 Series Language to the Model 1618 Language. This Special Function does not affect the 1618 mode configuration register in battery backed-up RAM, and does not provide full 1618 GPIB emulation if the instrument is not configured for 1618 mode.
	n.a.	GAL	Go to Alternate Language. Use when switching from C.I.I.L. or Model 1618 Languages to the 1700 Series Language.

Table 3-7. Special Functions — Continued

1700 Series Function	Front Panel Operation	1700 Series Programming Command	Description
CONFIGURE 1618 MODE	RECALL (dec. pt.) 1618 (units)	SPC 1618	Configures the instrument for the 1618 mode of GPIB operation by setting the 1618 mode configuration register in the battery backed-up RAM. (The instrument must be fitted Option 13 in order to use this Special Function.)
	RECALL (dec. pt.) 2100 (units)	SPC 2100	Configure the instrument for the expected output level for when the "N2100" 1618 Language command is received. To use this Special Function, first program the output level to the Specified Maximum Leveled Output of the Model 1618 that is to be emulated. Then use this Special Function to store the current output level into battery backed-up RAM. (The instrument must be fitted Option 13 in order to use this Special Function.)

3-11. C.I.I.L. PROGRAMMING LANGUAGE

3-11.1 The MATE Control Interface Intermediate Language consists of commands and language elements that correspond to the Abbreviated Test Language for All Systems (ATLAS). The ATLAS compiler generates the C.I.I.L. commands to be sent over the GPIB to instruments in an Automatic Test Equipment (ATE) system. Refer to IEEE Standard 416 ATLAS Test Language for detailed information on ATLAS.

3-11.2 The 1700 Series of instruments comply to the C.I.I.L. syntax for a "Stimulus" type module. See table 3-8 for the listing of C.I.I.L. commands implemented in the 1700 Series. The interpretation of the C.I.I.L. commands is the same as the interpretation used by the Systron Donner 1500 Series of instruments.

3-11.3 Table 3-9 lists the Nouns and Port Numbers used in Function and Reset statements that are implemented in the 1700 Series instruments. Using a Port Number other than listed for each Noun will generate an Illegal Function message.

3-11.4 Table 3-9 lists the Noun Modifiers and their associated values used in Set and Set Range statements that are implemented in the 1700 Series instruments. Set and Set Range statements with numeric values have an optional units field which immediately follows the numeric value. When the units field is not used, the 1700 Series assumes units to be in Hertz, dBm or seconds for frequency, output level, and sweep time values respectively.

Table 3-8. C.I.I.L. Commands

C.I.I.L. Command	Description	Interpretation by 1700 Series Instruments
FNC (noun): CH (port no.)	Function statement. The first statement in a setup sequence and indicates the type of signal being setup.	If port 0, initializes the instrument setup to the power up state, except the RF OFF control is not affected.
SET (noun modifier) (numeric or ASCII string value)	Set statement. Specifies a characteristic of the noun in the Function statement.	Sets an instrument control or parameter. See the table of Noun-Modifiers.
SRX (noun modifier) (numeric value)	Set range maximum. Same as Set statement except it sets the upper limit.	Sets the frequency or level sweep stop value. See the table of Noun-Modifiers.
SRN (noun modifier) (numeric value)	Set range minimum. Same as Set statement except it sets the lower limit.	Sets the frequency or level sweep start value. See the table of Noun-Modifiers.
CLS: CH (port number)	Close statement. Engages the designated port.	Closing port 0 turns the RF on, and if the frequency sweep or level sweep was setup, starts the sweep. Closing port 1, 2, or 3 will enable the external AM, FM, or Pulse modulation respectively.
OPN: CH (port number)	Open statement. Disengages the designated port.	Opening port 0 turns the RF off and the sweep off. Opening port 1, 2, or 3 will disable the external AM, FM, or Pulse modulation respectively.
RST (noun): CH (port no.)	Reset statement. Initialize to the quiescent state and disengage the designated port.	Resetting port 0 initializes the instrument setup to the power up state and turns the RF off. Resetting port 1, 2, or 3 will disable the external AM, FM, or Pulse modulation respectively.
CNF	Command to execute the Confidence Test. Upon completion of the test, initialize to the quiescent state and disengage all ports.	Runs the internal diagnostic routines. Any failure generates the Confidence Check failure message. (See the 1700 Series Service Manual for more details.)
IST	Command to execute the Internal-Self-Test. Upon completion of the test, initialize to the quiescent state and disengage all ports.	Runs the internal diagnostic routines. Each failure detected will generate an Instrument Fault message. (See the 1700 Series Service Manual for more details.)

Table 3-8. C.I.I.L. Commands — Continued

C.I.I.L. Command	Description	Interpretation by 1700 Series Instruments
STA	Command to report status.	No operation. The 1700 Series instruments will report their status whenever addressed to talk.
GAL	Go to alternate language.	Enables recognition of the 1700 Series Programming Language.

Table 3-9. C.I.I.L. Nouns

C.I.I.L. Noun	Description	Allowable Port Number(s)	Interpretation of Noun by 1700 Series Instruments
ACS	Alternating Current Signal	0	Ignored.
AMS	Amplitude Modulated Signal	0, 1	Used in a Function statement, a following Set Modulation Source statement will turn on the AM modulation.
FMS	Frequency Modulated Signal	0, 2	Used in a Function statement, a following Set Modulation Source statement will turn on the FM modulation.
PAM	Pulse Amplitude Modulated Signal	0, 3	Used in a Function statement, a following Set Modulation Source statement will turn on the FM modulation.
RFS	Radio Frequency Signal. This is not a standard C.I.I.L. noun.	0, 1, 2, 3	Ignored.
RSY	Radio Frequency Synthesizer. This is not a standard C.I.I.L. noun.	0, 1, 2, 3	Ignored.

3-11.5 The Noun Modifiers given without an interpretation for when used in a Set Range statement will generate an Illegal Setup message. Using values other than given for a Noun Modifier will also generate an Illegal Setup message. Using Noun Modifiers implemented in the Systron Donner 1500 Series instruments but not listed here will also generate an Illegal Setup message. Using units other than given for a Noun Modifier will generate an Incompatible Units message.

Table 3-10. C.I.I.L. Noun Modifiers

C.I.I.L. Noun Modifier	Description	Value(s) and Optional Units	Interpretation of Set Statement by 1700 Series Instruments
AMCP	Amplitude Modulation Component	(num. val.): DBM	Sets the output level sweep step size.
AMSC	Amplitude Modulation Source (not standard C.I.I.L.)	EXT	Enables external AM.
BURS	Burst (number of cycles of stimulus waveform)	(num. val.): CYCLES (num. val.): CYC	A value of one enables the single sweep mode. Any other value enables the continuous sweep mode.
CAMP	Carrier Amplitude	(num. val.): DBM	Sets the output level. In a Set Range Max. statement, sets the level sweep stop. In a Set Range Min. statement, sets the level sweep start.
CFRQ	Carrier Frequency	(num. val.): HZ (num. val.): KHZ (num. val.): MHZ (num. val.): GHZ	Sets the output frequency. In a Set Range Max. statement, sets the frequency sweep stop. In a Set Range Min. statement, sets the frequency sweep start.
FMCP	Frequency Modulation Component	(num. val.): HZ (num. val.): KHZ (num. val.): MHZ (num. val.): GHZ	Sets the frequency sweep step size.
FMSC	Frequency Modulation Source (not standard C.I.I.L.)	EXT	Enables external FM.
FREQ	Frequency	(num. val.): HZ (num. val.): KHZ (num. val.): MHZ (num. val.): GHZ	Sets the output frequency. In a Set Range Max. statement, sets the frequency sweep stop. In a Set Range Min. statement, sets the frequency sweep start.
FRTE	Frequency Rate	(num. val.): S/STEP (num. val.): MS/STEP	Sets the frequency sweep rate.
FSTA	Frequency Start	(num. val.): HZ (num. val.): KHZ (num. val.): MHZ (num. val.): GHZ	Sets the frequency sweep start.

Table 3-10. C.I.I.L. Noun Modifiers — Continued

C.I.I.L. Noun Modifier	Description	Value(s) and Optional Units	Interpretation of Set Statement by 1700 Series Instruments
FSTE	Frequency Step	(num. val.): HZ (num. val.): KHZ (num. val.): MHZ (num. val.): GHZ	Sets the frequency sweep step size.
FSTO	Frequency Stop	(num. val.): HZ (num. val.): KHZ (num. val.): MHZ (num. val.): GHZ	Sets the frequency sweep stop.
MDSC	Modulation Source (not standard C.I.I.L)	EXT	When preceded by a Function AM, FM, or Pulsed Ampl. Mod. statement, enables the external AM, FM, or Pulse modulation respectively.
MODS	Modulation Source (not standard C.I.I.L.)	EXT	When preceded by a Function AM, FM, or Pulsed Ampl. Mod. statement, enables the external AM, FM, or Pulse modulation respectively.
PAMP	Peak Amplitude	(num. val.): DBM	Sets the output level. In a Set Range Max. statement, sets the level sweep stop. In a Set Range Min. statement, sets the level sweep start.
POWR	Power	(num. val.): DBM	Sets the output level. In a Set Range Max. statement, sets the level sweep stop. In a Set Range Min. statement, sets the level sweep start.
PRTE	Power Rate (not standard C.I.I.L.)	(num. val.): S/STEP (num. val.): MS/STEP	Sets the output level sweep rate.
PSTA	Power Start (not standard C.I.I.L.)	(num. val.): DMB	Sets the output level sweep start.
PSTE	Power Step (not standard C.I.I.L.)	(num. val.): DBM	Sets the output level sweep step size.

Table 3-10. C.I.I.L. Noun Modifiers — Continued

C.I.I.L. Noun Modifier	Description	Value(s) and Optional Units	Interpretation of Set Statement by 1700 Series Instruments
PSTO	Power Stop (not standard C.I.I.L.)	(num. val.): DBM	Sets the output level sweep stop.
SWPT	Sweep Time	(num. val.): SEC (num. val.): S (num. val.): MS	Sets the frequency or level sweep rate by dividing the given sweep time by the number of steps. If the result is less than 10 ms or greater than 999 ms, then 10 ms or 999 ms is used. If the given sweep time is less than 20 ms, a Sweep Time out of Range message is generated.

3-11.6 The following illustrates typical C.I.I.L. Setup sequences sent from a GPIB controller to the 1700 Series instruments. The instrument is addressed to talk after being sent the Status statement. If instrument replies with a (space)<cr><lf>indicating its operating status is normal, then the controller sends the Close statement to cause the signal to be applied.

CW Signal

FNC ACS: CH0
  SET FREQ (value in Hz)
  SET PWR (value in dBm)<cr><lf>
STA<cr><lf>

CLS: CH0<cr><lf>

Swept Frequency Signal

FNC ACS: CH0
  SRN FREQ (start frequency in Hz)
  SRX FREQ (stop frequency in Hz)
  SET FMCP (frequency step in Hz)
  SET POWR (value in dBm)
  SET SWPT (sweep time in seconds)
  SET BURS (no. of sweeps; 1 is single sweep, otherwise continuous)
  <cr><lf>
STA<cr><lf>

CLS: CH0<cr><lf>

Swept Level Signal

FNC ACS: CH0
  SET FREQ (value in Hz)
  SRN POWR (start level in dBm)
  SRX POWR (stop level in dBm)
  SET AMCP (level step in dBm)
  SET SWPT (sweep time in seconds)
  SET BURS (no. of sweeps; 1 is single sweep, otherwise continuous)
  <cr><lf>
STA<cr><lf>

CLS: CH0<cr><lf>

Swept Frequency and Level Signal

FNC ACS: CH0
  SRN FREQ (start frequency in Hz)
  SRX FREQ (stop frequency in Hz)
  SET FMCP (frequency step in Hz)
  SRN POWR (start level in dBm)
  SRX POWR (stop level in dBm)
  SET SWPT (sweep time in seconds)
  SET BURS (no. of sweeps; 1 is single sweep, otherwise continuous)
  <cr><lf>
STA<cr><lf>

CLS: CH0<cr><lf>

AM Signal, Ext. Mod.

```
FNC AMS: CH0
  SET CFRQ (value in Hz)
  SET CAMP (value in dBm)
  SET MODS EXT<cr><lf>
STA<cr><lf>

CLS: CH0<cr><lf>
```

FM Signal, Ext. Mod.

```
FNC FMS: CH0
  SET CFRQ (value in Hz)
  SET CAMP (value in dBm)
  SET MODS EXT<cr><lf>
STA<cr><lf>

CLS: CH0<cr><lf>
```

Pulse Amplitude Mod.

```
FNC PAM: CH0
  SET CFRQ (value in Hz)
  SET PAMP (value in dBm)
  SET MODS EXT<cr><lf>
STA<cr><lf>

CLS: CH0<cr><lf>
```

3-12. MESSAGE SYNTAX

3-12.1 Whenever the 1700 Series instrument is addressed to talk in the 1700 Series Programming Languages or the C.I.I.L. language modes, the instrument will output a message in the C.I.I.L. response message format. The first character in the message will always be either a space or an "F". If the first character is an "F", the message is either a Programming Error message or an Instrument Fault message. If the first character is a space, the message is the requested data or information.

3-12.2 If there are no error messages waiting to be output when the instrument is addressed to talk, the instrument's response is (space)<cr><lf>.

3-12.3 If more than one error or fault message has been generated since the last time the instrument was addressed to talk, the messages wait in a queue. The queue can be emptied by using a Device Clear. The recommended procedure for handling the queued error messages is illustrated in the following pseudo code.

```
INPUT (SYNTH) STATUS$
IF FIRSTCHAR(STATUS$) < > "F"
THEN DISPLAY "OK"
ELSE
     REPEAT
          DISPLAY STATUS$
          INPUT (SYNTH) STATUS$
     UNTIL FIRSTCHAR(STATUS$) < > "F"
ENDIF
```

3-13. IEEE-488 INTERFACE COMMANDS

3-13.1 Device Clear and Selected Device Clear will disable Service Request, and clear all error messages not outputted. The error messages for persistent instrument faults will be generated again. If in Remote, the Device Clear and Selected Device Clear will initialize the instrument setup to its power-up state and turns the RF off.

3-13.2 A Service Request is generated when it is enabled and the instrument has an Error Message ready to be sent to the GPIB controller when it is talk addressed.

3-13.3 The bits in the Serial Poll byte are interpreted as follows:

Bit No.	Dec. Val.	Interpretation of Set Bit
DI01	1	Not used.
DI02	2	Not used.
DI03	4	Programming Error message waiting to be output when addressed to talk.
DI04	8	Instrument Fault message waiting to be output when addressed to talk.
DI05	16	Not used.
DI06	32	Abnormal operation is the current instrument condition. This bit is set whenever a Programming Error or Instrument Fault is waiting to be output. This bit stays set if an Instrument Fault persists.

Bit No.	Dec. Val.	Interpretation of Set Bit
DI07	64	The instrument is requesting service. Set when a Programming Error or Instrument Fault message is waiting to be output. Cleared after a Serial Poll has been conducted.
DI08	128	Not used.

3-14. PROGRAMMING ERROR MESSAGES

3-14.1 During remote operation, should the instrument detect an error in the commands transmitted by the controller; the instrument will output a Programming Error Message. Table 3-11 contains type of error message, possible error message outputted, and a paragraph number reference for the error.

3-15. INSTRUMENT FAULT MESSAGES

3-15.1 The following error messages may be outputted to the instrument when the internal error testing routines locate an equipment failure. Refer to the 1700 Series Microwave Synthesizer Service Manual for an explanation of these messages and corrective measures.

F07RSY00 (DEV):
A10 DIVIDE BY N UNLOCKED <cr> < lf>
F07RSY00 (DEV):
ALL REFERENCE SYNTH. UNLOCKED <cr>< lf>
F07RSY00 (DEV):
A12 TIME BASE VCXO UNLOCKED <cr> < lf>
F07RSY00 (DEV):
A13 OUTPUT PLL UNLOCKED <cr> < lf>
F07RSY00 (DEV):
A14 REFERENCE PLL UNLOCKED <cr> < lf>
F07RSY00 (DEV):
A3 OUTPUT UNLEVELED <cr> < lf >
F07RSY00 (DEV):
A8 FIXED L.O. PLL UNLOCKED <cr> < lf>
F07RSY00 (DEV):
EXT. TIME BASE REF. NOT PRESENT <cr> < lf >
F07RSY00 (DEV):
A2 RAM FAILURE <cr> < lf>
F07RSY00 (DEV):
A2 PROM FAILURE <cr> < lf>
F07RSY00 (DEV):
A2 EEPROM FAILURE <cr> < lf>
F07RSY00 (DEV):
A2 TIMER FAILURE <cr> < lf >
F07RSY00 (DEV):
A16 ANALOG TO DIGITAL CONV. FAIL <cr> < lf
F07RSY00 (DEV):
CONFIDENCE CHECK FAILURE <cr> < lf >
F07RSY00 (DEV):
INTERNAL SELF TEST # test no. <cr> < lf >

3-15.2 The following error messages are outputte by the instrument when the external modulatio inputs exceed the instrument specifications. Refer table 1-1 for allowable signal input.

F07RSY00 (DEV):
EXT. AM OVERLOAD<cr><lf>
EXT. FM OVERLOAD<cr><lf >

3-16. MODEL 1618B GPIB OPERATION OF THE 1700 SERIES (OPTION 13)

3-16.1 When the 1700 Series instruments are configured for the 1618 GPIB Mode and enter the remote state, or are in the remote state and the 1618 Mode and receive a device clear, the instrument setup is initialized to the Model 1618 wakeup state, as follows:

1700 Series Front Panel Control or Remote Command	Model 1618 Wakeup State
FREQ	2.000 000 0000 GHz
FREQ START	2.000 000 0000 GHz
FREQ STOP	2.000 000 0000 GHz
FREQ STEP	2.000 000 0000 GHz
FREQ RATE	0 ms
LEVEL	−70.0 dBm (0.0 dBm with Option 02)
SWEEP	OFF
SWEEP	SNGL
TRIG	POS
STEP	AUTO
AM	OFF
FM	OFF
ALC	INT
RF	ON

Table 3-11. 1700 Series Programming Error Messages

Error Message Type	Error Message	Paragraph Reference
C.I.I.L. ERROR	F07RSY00 (MOD): ILLEGAL FUNCTION <cr><lf>	3-10
	F07RSY00 (MOD): ILLEGAL SETUP <cr><lf>	3-11
	F07RSY00 (MOD): INCOMPATIBLE UNITS <cr><lf>	3-15
SYNTAX ERROR	F07RSY00 (MOD): ILLEGAL PROGRAM SYNTAX <cr><lf>	3-9 or 3-16
	F07RSY00 (MOD): ILLEGAL NUMERIC SYNTAX <cr><lf>	3-14
OUT OF RANGE	F07RSY00 (MOD): FREQUENCY OUT OF RANGE <cr><lf>	3-12 or 3-16
	F07RSY00 (MOD): START FREQUENCY OUT OF RANGE <cr><lf>	
	F07RSY00 (MOD): STOP FREQUENCY OUT OF RANGE <cr><lf>	
	F07RSY00 (MOD): FREQUENCY STEP OUT OF RANGE <cr><lf>	
	F07RSY00 (MOD): FREQUENCY SWEEP RATE OUT OF RANGE <cr><lf>	
	F07RSY00 (MOD): POWER OUT OF RANGE <cr><lf>	
	F07RSY00 (MOD): START POWER OUT OF RANGE <cr><lf>	
	F07RSY00 (MOD): SWEEP TIME OUT OF RANGE <cr><lf>	

3-16.2 Frequency Data Entry Procedure. With the synthesizer addressed to listen, an ASCII letter followed by an ASCII number, will be treated as frequency digit (address character) followed by the numerical value (digital character) of the digit. Table 3-12 lists valid address and digital characters.

Table 3-12. Frequency Program Coding

ASCII Code	Internal Function
H	Selects 10 GHz Digit
0—1	Value of 10 GHz Digit
G	Selects 1 GHz Digit
0—9	Value of 1 GHz Digit
F	Selects 100 MHz Digit
0—9	Value of 100 MHz Digit
E	Selects 10 MHz Digit
0—9	Value of 10 MHz Digit
D	Selects 1 MHz Digit
0—9	Value of 1 MHz Digit
C	Selects 100 kHz Digit
0—9	Value of 100 kHz Digit
B	Selects 10 kHz Digit
0—9	Value of 10 kHz Digit
A	Selects 1 kHz Digit
0—9	Value of 1 kHz Digit

3-16.3 An example of the program required to select a frequency of 12345.678 MHz (12.345678 GHz) is H1G2F3E4D5C6B7A8. Also, the order of each numerical value with its alphabetic address may be randomly entered, such as A8H1B7G2C6F3D5E4.

3-16.4 Digit characters in a frequency program string which are not preceded by an alphabetic address character, will decrement one position from the last alphabetic address for each digit character entered; thus, automatically selecting the next most significant digit. Because of this, frequency 12345.678 MHz may also be selected with H12345678, or F3H1G2E45678. Excess frequency digits will be interpreted as the value of the 100 Hz, 10 Hz, 1 Hz, and 1/10th Hz digits in 1700 Series instruments without Option 03.

3-16.5 To change frequency by small increments after frequency is programmed, it is only necessary to enter ASCII alphabetic address and digit value desired. For example, to change the previously programmed 12345.678 MHz frequency to 12345.678 MHz, just enter a program string of C5.

3-16.6 The Model 1618B ignores ASCII characters . , +, −, and spaces in a program string as well as those characters not included in its programming code. Program data will not be loaded into the synthesizer until an ASCII line feed is received. End or Identify is received with the last program character, or the listen active state is exited.

3-16.7 Digital Step Sweep. A remotely programmable digital sweep function, capable of sweeping in discrete programmed increments across the entire output frequency range or any portion thereof. Synthesizer pauses automatically at each frequency long enough to insure signal stability or can be programmed for longer delays. An "RF Valid" and a "TRIG IN" signal are available for use in a "handshake" mode for multipoint measurements. These are TTL level control signals accessed from bnc's on rear panel. See table 3-13 for programming commands.

3-16.8 Table 3-13 lists the Sweep Programming commands implemented in the Model 1618 that is fitted with Option 15. The "P", "Q" and "S" commands program the start, stop, and step frequencies by copying the last programmed output frequencies into the frequency start, stop, and step resistors. The receipt of any 1618 command other than "R" and "S" will turn the sweep off. The table also illustrates the use of the "U" command with one, two, and three digits.

Table 3-13. Model 1618B Sweep Programming Commands

Model 1618 Sweep Programming Command	Equivalent 1700 Series Programming Command
(freq. prog. string)P	FREQ START (num. val.)
(freq. prog. string)Q	FREQ STOP (num. val.)
R	SWEEP ON
S	STEP < cr>< lf >
(freq. prog. string)S	FREQ STEP (num. val.)
U1	FREQ RATE 0.100
U12	FREQ RATE 0.120
U123	FREQ RATE 0.123
X0	TRIG NEG
X1	TRIG POS
Y0	SWEEP SNGL
Y1	SWEEP TRIG
Y2	SWEEP CONT
Z0	STEP AUTO
Z1	STEP TRIG
Z2	STEP MAN

3-16.9 Output Level Data Entry Procedure. There are two methods of entering program data for the attenuator and level control functions of the Synthesizer. One method uses ASCII alphabetic address and ASCII numeric to program each digit of the attenuation display in −dB W. The other uses ASCII program code for separate step attenuator and vernier control. It is referenced to the specified maximum leveled output in dBr.

3-16.10 Method one uses the ASCII commands listed in table 3-14. The alphabetic ASCII commands are used as addresses for each digit position. The numeric following the alphabetic address is the value to be placed in the selected digit positions. The ASCII numeric character 0131 to 1500 provide output level programming in 0.1 dB increments. The values entered will be in − dBW and not dBm so that no sign need be entered. To reach dBW, take the displayed or the desired RF OUT level in dBm and subtract 30 (0 dBW = +30 dBm).

3-16.11 Digit characters in an attenuator program string which are not preceded by an alphabetic address character, will decrement one position from the last alphabetic address for each digit character entered; thus, automatically selecting the next most significant digit. For example, an output of −012.3 dBm or 042.3 dBW may be selected with N0423 or N0M4L2K3.

Table 3-14. Attenuator Program Coding

ASCII Code	Internal Function
N	Selects 100 dBW Digit
0—1	Value of 100 dBW Digit
M	Selects 10 dBW Digit
0—9	Value of 10 dBW Digit
L	Selects 1 dBW Digit
0—9	Value of 1 dBW Digit
K	Selects 0.1 dBW Digit
0—9	Value of 0.1 dBW Digit

3-16.12 To change the level by small increments after the level is programmed, it is only necessary to enter ASCII alphabetic address and digit value desired. For example, to change the previously programmed −012.3 dBm level to −013.3 dBm just enter a program string of L3.

3-16.13 The second method of selecting output level, using the GPIB, makes use of a split-programming code. This split-code method permits programming a vernier overrange of 10 dB, and an underrange of 15 dB, while maintaining a fixed-step attenuation which is referenced to the specified maximum leveled output (dBr). The specified maximum leveled output will differ with option configuration (see table 3-15).

Table 3-15. Specified Maximum Leveled Output

1618B Configuration	Specified Maximum Leveled Output
Standard	+3 dBm
Option 02	+5 dBm
Options 02 and 03	+2 dBm
Option 03	0 dBm
Option 05	0 dBm

NOTE

Before using the split mode method, the 1700 Series instrument must have stored in battery backed up RAM the specified maximum leveled output of the Model 1618 to be emulated. See the description of Special Function number 2100 in table 3-7, Special Functions.

3-16.14 The split-programming method provides three modes of control:

1. Individual control of STEP ATTENUATOR (see table 3-16).
2. Individual control of LEVEL VERNIER (see table 3-17).
3. Combined control of STEP ATTENUATOR and LEVEL VERNIER.

Table 3-16. Attenuator Programming for Split-Mode Operation

ASCII Code	Step Attenuation
N2	0 dB
N3	10 dB
N4	20 dB
N5	30 dB
N6	40 dB
N7	50 dB
N8	60 dB
N9	70 dB
N:	80 dB
N;	90 dB
N<	100 dB
N=	110 dB

Table 3-17. Vernier Programming for Split-Mode Operation

ASCII Code	Output Relative to Specified for Split-Mode Operation
N2000	+10.0 dBr
N2010	+09.0 dBr
N2020	+08.0 dBr
N2030	+07.0 dBr
N2040	+06.0 dBr
N2050	+05.0 dBr
N2060	+04.0 dBr
N2070	+03.0 dBr
N2080	+02.0 dBr
N2090	+01.0 dBr
N2100	+00.0 dBr*
N2110	−01.0 dBr
N2120	−02.0 dBr
N2130	−03.0 dBr
N2140	−04.0 dBr
N2150	−05.0 dBr
N2160	−06.0 dBr
N2170	−07.0 dBr
N2180	−08.0 dBr
N2190	−09.0 dBr
N2200	−10.0 dBr
N2210	−11.0 dBr
N2220	−12.0 dBr
N2230	−13.0 dBr
N2240	−14.0 dBr
N2250	−15.0 dBr

*Specified maximum leveled output (see table 3-15).

NOTE

ASCII N2 programs a 0 dB attenuator step. Programming of vernier overrange (above 0 dBr) may cause inaccuracies if the programmed level exceeds the available output power of the oscillator device.

3-16.15 Individual step attenuator control is programmed using ASCII code N2 through N= which provides 0 to 110 dB in 12 steps (see table 3-16).

Individual vernier control is programmed using three digits, 000 to 250, following the N digit (see table 3-17). This provides a 0.1 dB stepped vernier range from +10 to −15.0 dBr (0 dBr being the specified attenuator and vernier control is programmed using the three digits, 000 to 250, following the N digit value (N3 to N=), thus providing a range from 0 to −125 dBr. Table 3-16 provides the ASCII codes for 1.0 dB step resolution. The synthesizer can be programmed to 0.1 dB resolution. For example; an output level of −012.3 dBm may be programmed with ASCII command N3153, for the standard +3 dBm specified maximum leveled output (−15.3 dBr +3 dBm = −012.3 dBm or −042.3 dBW).

NOTE

Programming under or over the vernier calibrated range may cause inaccuracies.

3-16.16 Mode Programming Procedure. The three synthesizer modes of operation are selectable using the GPIB programming code listed in table 3-18. To program CW, apply an ASCII letter O followed by the ASCII digit 0.

Table 3-18. Mode Program Coding

ASCII Code	Internal Function
00	Selects CW Mode
01	Selects EXT FM Mode
	Selects EXT AM Mode
03	Selects EXT FM and EXT AM Modes
04	Selects EXT ALC Mode
05	Selects EXT ALC and EXT FM Modes
06	Selects EXT ALC and EXT AM Modes
07	Selects EXT ALC, EXT FM, and EXT AM Modes

3-16.17 Status Reporting — Talk Mode. The operating status of Model 1618B is available when the synthesizer is addressed to talk after data received. The operating status is output in octal form followed by a carriage return (CR) and a line feed (LF). Table 3-19 lists the ASCII code for the indicated status.

Table 3-19. Status Output Coding

ASCII	Code	Output	Internal Status
0	CR	LF	Locked and Leveled
1,	CR,	LF	Locked and Leveled
2,	CR,	LF	Locked and Leveled
3,	CR,	LF	Locked and Leveled

3-18. PULSE MODULATION OPERATION WITH OPTION 13

3-18.1 The Model 1618 fitted with pulse modulation has the pulse modulation enabled by an Automatic Pulse Control Circuit instead of using a front panel control or a remote command. Whenever pulses are sensed at the pulse input connector, this circuit will automatically enable the pulse modulation.

3-18.2 The 1700 Series instruments fitted with Option 13 have the Automatic Pulse Control function implemented in microprocessor firmware in addition to the front panel control and the remote command.

3-18.3 When a 1700 Series instrument is configured for the 1618 mode of GPIB operation, the Automatic Pulse Control is activated, and it will automatically enable the pulse modulation in the same manner as the Model 1618.

3-18.4 When the front panel control or remote command is used, the Automatic Pulse Control is overridden. The manual control of pulse modulation is only in effect while there are no changes in the conditions tested by the Automatic Pulse Control firmware. Table 3-20 lists the state transitions for Automatic Pulse Control for each condition.

Table 3-20. State Transition for Automatic Pulse Control

State	Condition	Action	Next State
Initial (off)	Sense ext. pulse key or rem. cmd.	Pulse on Pulse on	Auto pulse on Man. pulse on
Auto pulse on	Don't sense ext. pulse key or rem. cmd.	Pulse off Pulse off	Initial Man. pulse off
Man. pulse on	Sense ext. pulse key or rem. cmd.	No operation Pulse off	Auto pulse on Initial
Man. pulse off	Don't sense ext. pulse key or rem. cmd.	No operation Pulse on	Initial Auto pulse on

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